

THE NEW  
FUNK & WAGNALLS  
ENCYCLOPEDIA

# THE ~~N~~<sup>E</sup>~~W~~ FUNK & WAGNALL'S ENCYCLOPEDIA



VOLUME 32

SUDITES — THOLUCK

Prepared Under the Editorial Direction of

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With an Editorial Staff of Experts and with the Help of Leading Scholars,  
Scientists, and Educators, United States and Foreign, Government  
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Based on the Funk & Wagnalls New Standard Encyclopedia  
compiled under the editorship of the late FRANK H. Vizetelly

UNICORN PUBLISHERS, INC., NEW YORK



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## LIST OF ABBREVIATIONS USED

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<b>abbr.</b> , abbreviated	<b>Fr.</b> , French	<b>OF.</b> , Old French
<b>A.D.</b> , Anno Domini	<b>ft.</b> , foot	<b>OHG.</b> , Old High German
<b>alt.</b> , altitude	<b>Gael.</b> , Gaelic	<b>ON.</b> , Old Norse
<b>A.M.</b> , ante meridiem	<b>Gen.</b> , General	<b>ONF.</b> , Old Norman French
<b>anc.</b> , ancient	<b>Ger.</b> , German	<b>O.T.</b> , Old Testament
<b>approx.</b> , approximately	<b>Gr.</b> , Greek	<b>oz.</b> , ounce
<b>Ar.</b> , Arabic	<b>Heb.</b> , Hebrew	<b>P.M.</b> , post meridiem
<b>AS.</b> , Anglo-Saxon	<b>Hind.</b> , Hindustani	<b>Pol.</b> , Polish
<b>A.S.S.R.</b> , Autonomous Soviet Socialist Republic	<b>Hon.</b> , Honorable	<b>pop.</b> , population
<b>at.no.</b> , atomic number	<b>h.p.</b> , horsepower	<b>Port.</b> , Portuguese
<b>at.wt.</b> , atomic weight	<b>hr.</b> , hour	<b>pron.</b> , pronounced
<b>b.</b> , born	<b>Hung.</b> , Hungarian	<b>q.v.</b> , which see
<b>B.C.</b> , before Christ	<b>I.</b> , Island	<b>R.</b> , River
<b>b.p.</b> , boiling point	<b>i.e.</b> , that is	<b>Rev.</b> , Reverend
<b>B.T.U.</b> , British Thermal Unit	<b>in.</b> , inch	<b>Rom.</b> , Romanian
<b>Bulg.</b> , Bulgarian	<b>Ind.</b> , Indian	<b>Russ.</b> , Russian
<b>C.</b> , centigrade, syn. Celsius	<b>Ir.</b> , Irish	<b>S.</b> , south, southerly, southern
<b>cap.</b> , capital	<b>It.</b> , Italian	<b>sec.</b> , second
<b>cent.</b> , century	<b>Jr.</b> , junior	<b>Skr.</b> , Sanskrit
<b>Chin.</b> , Chinese	<b>kg.</b> , kilogram	<b>Sp.</b> , Spanish
<b>cm.</b> , centimeter	<b>km.</b> , kilometer	<b>sp.gr.</b> , specific gravity
<b>Co.</b> , County	<b>lat.</b> , latitude	<b>sq.</b> , square
<b>colloq.</b> , colloquial	<b>Lat.</b> , Latin	<b>S.S.R.</b> , Soviet Socialist Republic
<b>cu.</b> , cubic	<b>lb.</b> , pound	<b>Sum.</b> , Sumerian
<b>Czech.</b> , Czechoslovakian	<b>lit.</b> , literally	<b>Sw.</b> , Swedish
<b>d.</b> , died	<b>long.</b> , longitude	<b>syn.</b> , synonym
<b>Dan.</b> , Danish	<b>m.</b> , mile	<b>temp.</b> , temperature
<b>Du.</b> , Dutch	<b>M.</b> , Middle	<b>trans.</b> , translation, translated
<b>E.</b> , east, easterly, eastern	<b>min.</b> , minute	<b>U.K.</b> , United Kingdom
<b>ed.</b> , edition	<b>M.L.</b> , Medieval Latin	<b>U.N.</b> , United Nations
<b>e.g.</b> , for example	<b>mm.</b> , millimeter	<b>U.S.</b> , United States
<b>Egypt.</b> , Egyptian	<b>mod.</b> , modern	<b>U.S.A.</b> , United States of America
<b>Eng.</b> , English	<b>m.p.</b> , melting point	<b>U.S.S.R.</b> , Union of Soviet Socialist Republics
<b>est.</b> , estimated	<b>M.P.</b> , Member of Parliament	<b>var.</b> , variety
<b>et seq.</b> , and following	<b>m.p.h.</b> , miles per hour	<b>vol.</b> , volume
<b>F.</b> , Fahrenheit	<b>Mt.</b> , Mount, Mountain	<b>W.</b> , west, westerly, western
<b>fl.</b> , flourished	<b>N.</b> , north, northerly, northern	<b>yd.</b> , yard
<b>fr.</b> , from	<b>N.T.</b> , New Testament	
	<b>OE.</b> , Old English	

**Notes.**—The official abbreviations for the States of the Union are used throughout. For academic degrees, see article DEGREE, ACADEMIC. Other abbreviations or contractions are self-explanatory.



# THE NEW FUNK & WAGNALLS ENCYCLOPEDIA

**SUDETES** or **SUDETIC MOUNTAINS**, a mountain system of central Europe. The system extends along the N. frontier of Czechoslovakia from the valley of the Oder R., which separates the uplift from the N.W. extremity of the Carpathians, to the water gap of the Elbe R., which separates it from the Erz Gebirge (q.v.). The length of the system is about 190 m. Of the various ranges composing the Sudetes, the best defined and most elevated is Riesen Gebirge. Elevations in this range, which occupies the central portion, average about 4200 ft. Its highest summit is Schneekoppe (5265 ft.). Among the lesser ranges of the system are Isergebirge and Glatzgebirge. The slopes, valleys, and foothills of the Sudetes are rich in natural resources, including dense pine forests, considerable pasturage, extensive tracts of arable lands, and ~~mines~~ of copper, zinc, lead, coal, and iron ores.

**SUDRA**. See CASTE.

**SUE**, MARIE JOSEPH, known as EUGÈNE (1804-59), French novelist, born in Paris. He wrote a number of novels, among which the best known is *The Wandering Jew* (1844-45). Sue was elected deputy for Seine in 1850; he joined the extreme left.

**SUECA**, a town of Spain, in the province of Valencia, 23 miles S. of the city of that name, on the left bank of the Júcar. It is in a fertile valley. Pop., about 18,000.

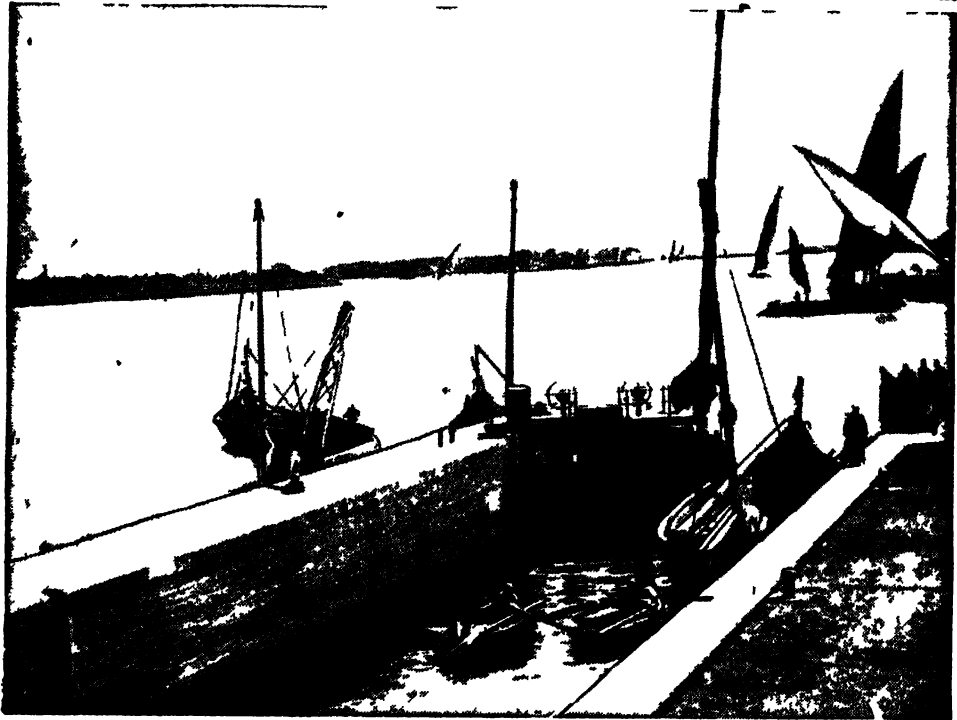
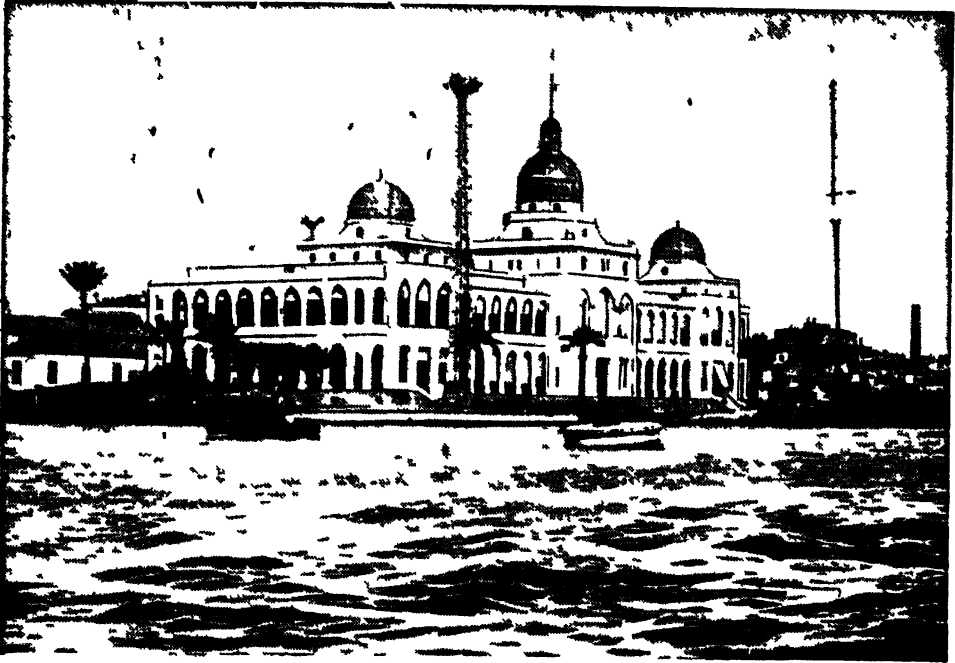
**SUESS**, EDUARD (1831-1914), Austrian geologist, born in London. He was professor of geology at the University of Vienna, a member of the Austrian lower house, and president of the Imperial Academy of Science. His contributions to geology, which opened up a new path in geological inquiry, and laid the foundation for what is frequently termed the "new geology", deal with the construction and relations of continents and mountain ranges, the dynamics of volcanoes and earthquakes, and the general movements of the earth's crust. His *Antlitz der Erde* (1883-1901) is translated as *Face of the Earth* (1904-09).

**SUETONIUS**, in full GAIUS SUETONIUS TRANQUILLUS (70?-160? A.D.), Roman biographer and historian. He was a friend of Pliny the Younger (q.v.), who, when appointed proconsul of Bithynia by the emperor Trajan, took Suetonius with him as a companion. After Pliny's death Suetonius

was befriended by Gaius Septicius Clarus, prefect of the Prætorian Guard, to whom he dedicated his well-known work, *The Lives of the Cæsars*. As private secretary to the emperor Hadrian from 119 to 121 A.D., Suetonius had access to imperial documents and was able to verify the facts in this work. The biographies contain information about twelve rulers of Rome, from Gaius Julius Cæsar to the emperor Domitian, which is found nowhere else; much of it is in the form of scandalous anecdotes. Suetonius was the author of numerous other works now lost, including *Miscellanies*, an encyclopedic work on Roman antiquities and scientific subjects; *On Famous Courtesans*; *On the Kings*; *On Public Offices*; and *On Critical Marks in Books*. His *De Viris Illustribus* contains biographies of poets, orators, philosophers, historians, grammarians, and rhetoricians; most of the section on grammarians and rhetoricians, and also the biographies of several poets, including those of Terence, Vergil, and Horace, have been preserved.

**SUEVI** or **SUEBI**, the collective name for a number of warlike German tribes, mentioned by Gaius Julius Cæsar as dwelling E. of the Rhine R.; the historian Publius Cornelius Tacitus describes them as inhabiting all central Germany W. of the Oder R. to the Danube R., except a strip along the Baltic Sea occupied by the Harudes. The Suevi allied themselves with the Alemanni and other barbaric tribes early in the 5th century A.D., and helped to demolish the Roman Empire in the W. and N.W. They swept down upon Spain in 409 A.D., but were later defeated by the Franks under Clovis (q.v.). The Suevi who remained in Germany seem to have spread to the E. and S., and the medieval Swabians were their direct descendants. See SWABIA.

**SUEZ**, a town of Egypt, situated on the south coast of the Isthmus of Suez, at the north extremity of the gulf of that name, and near the southern terminus of the Suez Canal. It is built on a desert peninsula. The European quarter contains the large warehouses of the Peninsular and Oriental Steamship Company. There are also a large English and a French hospital, and the town is supplied with water from the Nile at Cairo through a fresh-water canal. To the south a large stone causeway, carrying a railroad,



British Information Services, Hamilton Wright

*Top Office of the Suez Canal Company, the most imposing building on the waterfront of Suez, Egypt Bottom Lock on a section of the Suez Canal*

runs to the immense harbor of Port Ibrahim, at the entrance to the canal, 2 miles s. of the town. Suez has railroad connection with Cairo and Ismailia, but its commerce is not very large. Pop. (1947) 108,250.

**SUEZ CANAL**, a canal 103 m. long (including 4 m. of approach channels), which crosses the Isthmus of Suez and connects Port Said on the Mediterranean Sea with Suez on the Red Sea. The Egyptian king, Rameses II, seems to have been the first to excavate a canal between the Nile delta and the Red Sea. This, having been allowed to fill up and become disused, was reopened by Darius I of Persia. It was once more cleared and made serviceable for the passage of boats by the Arab conquerors of Egypt. The French diplomat Ferdinand De Lesseps (q.v.) set himself, in 1849, to study the isthmus thoroughly, and in 1854 he managed to enlist the interest of Said Pasha, Khedive of Egypt, in his scheme for connecting the Mediterranean with the Red Sea. Two years later the Porte granted its permission and the Universal Company of the Maritime Suez Canal was formed, receiving important concessions from the ruler of Egypt.

The work was begun on April 25, 1859, and on November 17, 1869, the canal was duly opened for vessels. Between 1885 and 1889 the canal was enlarged and improved, and altogether over \$100,000,000 were spent in its construction. The width of the water surface was at first 150 to 300 ft., the width at the bottom 72 ft., and the minimum depth 26 ft. At Port Said two strong breakwaters, 6940 and 6020 ft. long respectively, were run out into the Mediterranean; at Suez another substantial mole was constructed. The making of the canal was facilitated by the existence of three or four valleys or depressions (formerly lakes), which, when the water reached them, became converted into lakes.

The strategic importance of the Suez Canal for military purposes during World War I and the steady increase in traffic in subsequent years necessitated a program of widening and deepening its waterway to take care of the increasingly large vessels which were passing through annually. Improvements were, therefore, carried out in accordance with plans made in 1921, to increase the minimum depth to 42 ft. 6 in., the minimum bottom width to 196 ft. 8 in., to reduce the curves, and increase the width at many points. Previous to the war, the traffic through the canal was about 21,000,000 tons annually, but during the war it declined to

between 13,000,000 and 14,000,000 tons. By 1923, however, it had surpassed all previous records, and continued to increase. In a recent year net tonnage (commercial) through the canal was nearly 54,000,000.

With the advent of World War II, warships and transports predominated among ships passing through the canal and as in World War I, regular traffic fell off.

The British government holds 295,026 shares of the total of 652,932 shares of the French corporation which owns the canal. A board of 32 administrators (18 French, 10 British, 2 Egyptian, 1 American, and 1 Dutch) govern the canal.

Under the terms of an international convention signed in 1888 the canal is open to the vessels of all nations and is free from blockade. However, Great Britain, by the provisions of the Anglo-Egyptian Treaty of 1936, maintains defense forces in the Suez Canal Zone and thus commands the canal approaches. The Egyptian government systematically violated the 1888 convention after the outbreak (1948) of war between Israel and the nations of the Arab League by prohibiting the transit of vessels en route to Israel. On Sept. 1, 1951, the U.N. Security Council adopted a resolution requesting Egypt to terminate the blockade, but the resolution was ignored.

Leading Egyptian nationalists had demanded repeatedly, meanwhile, that Great Britain evacuate the Suez Canal Zone, and in October, 1951, Egypt abrogated the 1936 treaty. The British government responded to this action by reinforcing its Canal Zone garrison. Anglo-Egyptian relations improved after the abdication of King Farouk and in April, 1953, the two governments began negotiations on the question of British withdrawal from the Canal Zone.

**SUEZ, GULF OF**, an arm of the Red Sea between the Sinai Peninsula and the main portion of Egypt. It has a length of 187 miles with a breadth of from 14 to 39 miles. At its north end, which is the extreme north end of the Red Sea, it is connected with the Mediterranean Sea by the Suez Canal.

**SUEZ, ISTHMUS OF**, the neck of land 72 m. wide connecting the Sinai Peninsula with the mainland of Egypt and separating the Mediterranean from the Red Sea. The isthmus consists of a low, sandy, and stony desert, the lowest depressions being occupied by salt lakes and marshes, and it is almost wholly destitute of fresh water. A series of such depressions extends across the isthmus from the great coast lagoon in the north to

the Gulf of Suez, and affords the route for the Suez Canal.

**SUFFERN**, a village in Rockland Co., NY., 32 miles N.W. of New York City, on the Ramapo River. There are ironworks, a foundry, and perfume factory. Pop. (1950) 4010.

**SUFFIELD**, a town in Hartford Co., Conn., 16 miles N. of Hartford, on the Massachusetts border. It has manufactures of tobacco and cigars. Pop. (1950) 4895.

**SUFFOCATION**. See ASPHYXIA.

**SUFFOLK**, a city of Virginia, and county seat of Nansemond Co., of which it is politically independent. It is situated on the Nansemond R., 17 miles W. of Portsmouth. Transportation facilities include five railroads. Suffolk is the largest peanut market in the world, and the center of a rich agricultural region yielding peanuts, corn, cotton, and timber. Among the industrial establishments in the city are the largest peanut-processing plant in the world, and lumber mills, meat-packing plants, a cotton gin, hosiery and textile mills, and factories manufacturing machinery, chemicals, bricks, paper boxes, screens, barrels, caskets, wood veneers, fertilizers, candy, and overalls. Educational facilities in the city include Nansemond Collegiate Institute, for Negroes. Suffolk was founded in 1742, incorporated as a town in 1808, and chartered as an independent city in 1910. Pop. (1950) 12,339.

**SUFFOLK, EAST and WEST**, maritime counties of S.E. England. The surface is generally flat, falling away into marshes on the N.W. and N.E. borders. The tributaries of the Waveney and of the Stour, the Lark, and the Gipping are the chief rivers. The county seat of East Suffolk is Ipswich (q.v.), a county borough, and the county seat of West Suffolk is Bury St. Edmunds (q.v.). The principal industry is agriculture, and the counties are two of England's chief grain-raising areas. Other crops include sugar beets, clover, turnips, peas, and beans. Dairying is important and cattle, sheep, horses, and pigs are raised. The principal manufactures include agricultural implements, artificial manure, malt, and cotton, linen, and silk textiles. The area of East Suffolk, excluding the county borough of Ipswich, is 858 sq.m.; pop. (1951 prelim.) 321,849. The area of West Suffolk is 611 sq.m.; pop. (1951 prelim.) 120,590.

**SUFFRAGE**, the right of voting for candidates for public office and on measures submitted to the electorate in plebiscites and

referendums (q.v.); in modern times, an essential element of political liberty and democratic government. The history of suffrage is in great part the history of the evolution of democracy (q.v.). Different conceptions of suffrage attended the development of voting from antiquity to modern times. Among primitive peoples and among the city-states of antiquity, suffrage was regarded as a prerogative of citizens. The tendency in ancient Greece and Rome was to extend the basis of suffrage by conferring citizenship, limited at first to privileged social and economic and dominant political groups, on various classes of the population; the Romans also granted citizenship to certain conquered peoples. In both Greece and Rome, suffrage was restricted to adult males. Among the Germanic peoples of the early Middle Ages, suffrage was an attribute of membership in the tribe and was limited to the adult males bearing arms, who voted in the folk-moot, or tribal assembly, by shaking their spears or clashing their arms. Among the Italian city-states during the Renaissance, suffrage was also regarded as an adjunct of citizenship.

In feudal European society during the later Middle Ages, suffrage was a privilege of social status, usually but not invariably associated with possession of land. In England, suffrage was restricted to taxpayers, burgesses, freemen, and certain freeholders and house-holders. The theory of suffrage as a natural and, therefore, inalienable right of man and as an essential element of popular sovereignty was emphasized in England in the 17th century by the Levellers (q.v.) during the Commonwealth of Oliver Cromwell. In France in the 18th century, it was advocated by the philosopher Jean Jacques Rousseau and his contemporaries and, in consequence of their influence, by most of the leaders of the French Revolution. An identical attitude toward suffrage was propounded in the English New World colonies in the 18th century and gradually prevailed over the older conception, brought to America from England, of suffrage as a privilege of powerful landed, financial, and commercial interests and social status. For an account of the development of suffrage in the United States, see **ELECTORAL REFORM**.

The prevailing contemporary attitude toward suffrage holds it to be, not a natural right, but a right created by law and conferred by government; it is, therefore, a right which may be expanded, limited, or



abolished by due process of law. The constitution and basic laws of virtually all countries now provide for universal suffrage, and the prevailing trend is for the enfranchisement of women on a basis of equality with men; see WOMAN SUFFRAGE. The extent to which governments invest the right of suffrage with an effective influence in the selection of public officials is an important criterion in evaluating them as democratic or dictatorial states. In countries in which only one political party is permitted by law, as in fascist Spain under Francisco Franco and the Soviet Union under Joseph Stalin and, later, Georgi Malenkov, and in countries in which elections are characterized by the submission to the electorate of only a single slate of candidates, voting constitutes merely a democratic façade for dictatorial government. See BALLOT; ELECTIONS; LIBERTY.

**SUFFREN SAINT TROPEZ**, PIERRE ANDRÉ DE (1726-88). French naval hero, born in Saint-Cannat, near Lambese. He was captured by the British naval commander Edward Hawke in 1747 and after his exchange served for several years in the vessels of the Knights Hospitalers of Malta. He was again with the French navy in the Seven Years' War, in 1767 returned to the service of the Knights of Malta, and in 1772 was commissioned as a captain in the French navy. In 1778-79, during the American Revolution, he served with distinction in the squadron of Comte D'Estaing which operated off the American coast and in the West Indies. In 1781 he was given command of a squadron of five ships, sent out against a British fleet under Commodore George Johnstone. He found Johnstone's fleet in Porto Praya, Cape Verde Islands, and inflicted so much damage that the British expedition failed in its purpose of conquering the Dutch South African settlements. He then proceeded to the East Indies, where his actions against the superior forces of the British Admiral Sir Edward Hughes were among the most brilliant operations ever performed by a French naval commander. The strategic results of his campaign were most important, and if proper use of them had been made by the French land forces, the British hold upon India would have been seriously menaced. Suffren was made a vice-admiral.

**SUFISM**, a system of Mohammedan mysticism, having its home chiefly in Iran. Mohammedanism is not a mystical religion, but it contained from the first elements which could be used by mystics. Not till its second

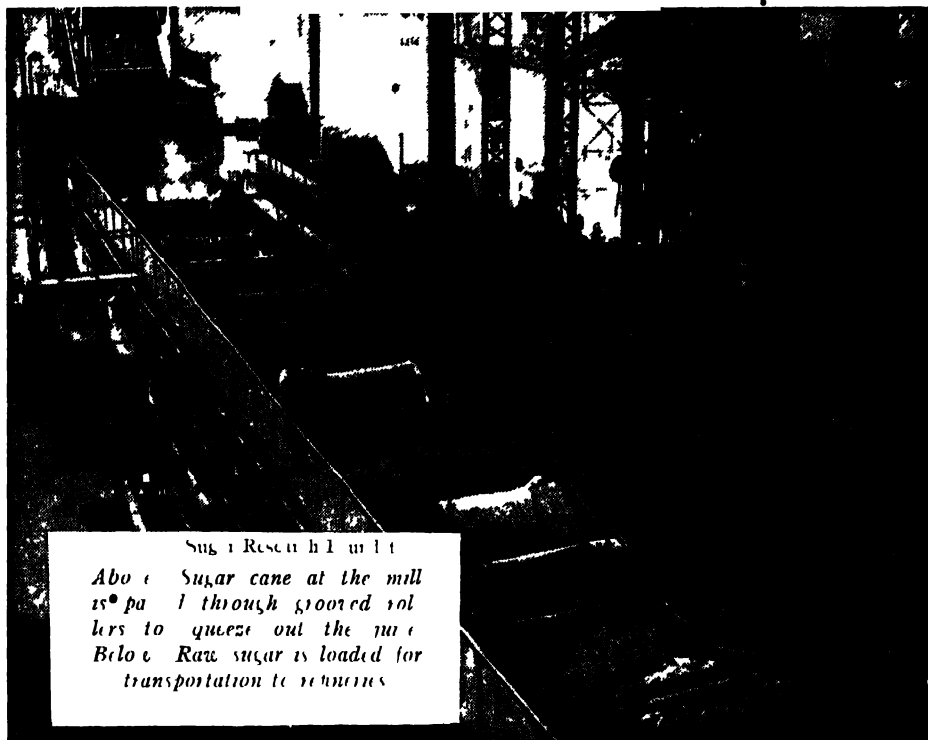
century did mysticism become organized in it. The Sufi "way to God" is similar to the well-known ideas on that subject among Western mystics. With the help of a guide, "the traveler" ascends step by step to union with God or through awakening to regeneration and sanctification to union. The "Way" is ascetic and full of occult practices, such as dances and silences, and leads to the mystic trance of perfect union with God, when man loses all sense of independent individuality. The most brilliant Iranian poetry is Sufi. Aside from Rumi, the Sufi poets are Nizami, Farid ud din Attar, Sadi, Shamsi, Hafiz, Anvari, Jami, and Hatifi. It may be added that Omar Khayyam (d. 1123), known to the West through Fitz-Gerald's translations, was not a Sufi. Jamī (d. 1492) has been called the last Sufi. After him Sufism slowly declined, but the 19th century saw its powerful revival in Turkey, though its Turkish representative names are almost unknown outside of Turkey. From Turkey and Egypt comes what may be called a Neo-Sufism.

**SUGAR**, term applied loosely to any of a number of chemical compounds in the carbohydrate group which are readily soluble in water, colorless, odorless, usually crystallizable, and more or less sweet in taste. In general, all monosaccharides, disaccharides, and trisaccharides (see CARBOHYDRATES) are termed sugars, as distinct from polysaccharides such as starch, glycogen, and cellulose. Sugars are widely distributed in nature, being manufactured by plants during the process photosynthesis (q.v.), and being found in many animal tissues; see SUGAR METABOLISM. OR. Ribose, a monosaccharide sugar containing five carbon atoms in its molecule, is a constituent of the nuclei of all animal cells; five-carbon sugars are known as *pentoses*. *Trioses* (three-carbon sugars), *tetroses* (four-carbon sugars), *heptoses* (seven-carbon sugars), *octoses* (eight-carbon sugars), and *nonoses* (nine carbon sugars) are also found in nature, but the most widespread of the sugars are the *hexose sugars*, characterized by the presence of six carbon atoms in the molecule and by an empirical formula of  $C_6H_{12}O_6$ . The various hexoses, having the same empirical formula and molecular weight, are structural isomers of each other; see ISOMERISM. Each hexose is known in a dextrorotatory and levorotatory form, which in solution will rotate the plane of a beam of polarized light to the right or the left, respectively; but all hexoses taken into the



Strain Oil C (N J), Sugar Research Found  
*Above Planting newly cut seed sugar cane on a plantation in the Bayou Sale district of Louisiana Left Harvesting sugar cane with machetes Below Derrick loading sugar cane on a truck in Hawaiian Islands*







Sugar Research Foundation

*Above: Sugar beets on a conveyor belt being moved from storage piles to the factory for processing. Left: A sugar beet. Below: In the factory the beets are shredded and soaked in hot water to remove the sugar content.*



animal body are converted into dextrorotatory forms. The most important of the hexose sugars are glucose and galactose (q.v.), which are aldehydes, and fructose (q.v.) which is a ketone.

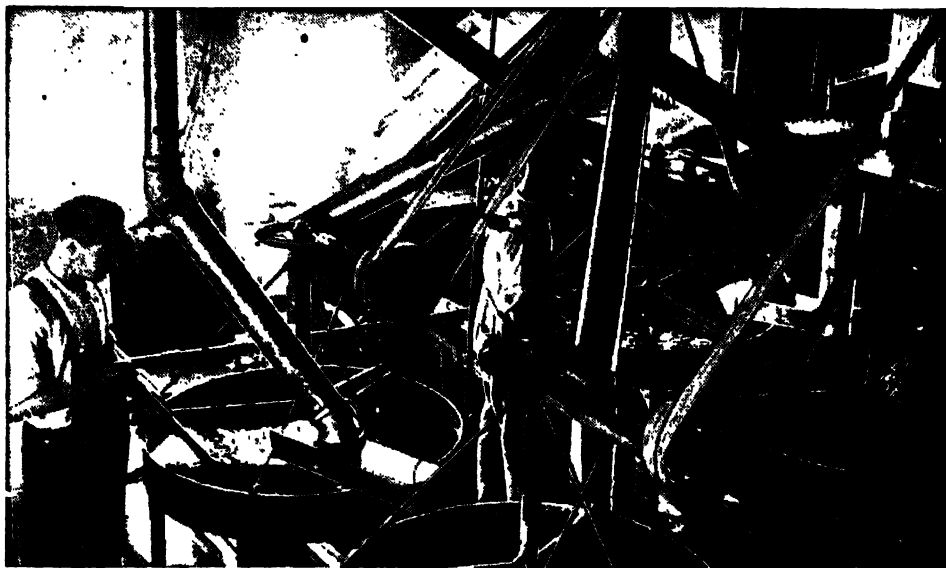
More important commercially than the monosaccharide hexose sugars are the disaccharide sugars maltose, lactose, and sucrose (q.v.); these sugars have the empirical formula  $C_{12}H_{22}O_{11}$ . When treated with acids or enzymes, the disaccharides combine with one molecule of water and split into two molecules of monosaccharide hexose sugar. Maltose, for example, splits into two molecules of glucose when so treated; lactose splits into one molecule of glucose and one of galactose; and sucrose splits into one molecule of glucose and one of fructose.

Most of the important sugars, with the exception of sucrose, reduce (see OXIDATION) cupric oxide in alkaline solution to cuprous oxide. This reaction is used in qualitative tests of the amount of sugar in the urine (see FENLINC'S SOLUTION) and the blood, and in quantitative tests of the amount of sugar in the blood; such tests are important in the diagnosis and control of diabetes mellitus (q.v.).

Among the commercially important sugars are glucose, lactose, and maltose, which are widely used in infant feeding; most important, however, is sucrose, also called saccharose or "cane sugar". (Sucrose is generally known as "cane sugar" even when its source is not the sugar cane.) Sucrose is an important article in the diet of man, being used as a sweetening agent for foods and in the manufacture of candies, cakes, puddings, preserves, soft and alcoholic beverages and many other articles. As a basic foodstuff sucrose supplies about thirteen percent of all the energy man derives from foods. More sucrose is manufactured annually than any other organic compound; about 75,000,000,000 pounds of this sugar are produced throughout the world each year. About 14,000,000,000 pounds of sucrose are consumed in the United States each year during peacetime; wartime consumption is much greater because the sugar is a raw product from which industrial alcohol, essential for the manufacture of explosives, is made; see FERMENTATION. Sucrose is present in limited quantities in many plants, including various palms, but the sugar maple (see MAPLE), the sugar beet (q.v.), and the sugar cane (q.v.) are the only commercially important sources. Most of the world's sugar supply is obtained

from the sugar cane and the sugar beet, more sugar being derived from the cane than from the beet. The sugar beet grows in temperate countries, and is the chief source of sugar for most of Europe, extensive growing being carried on in Germany, Austria, Russia, and France. The northern United States also is a center for sugar-beet production; sugar cane is grown in the United States in Louisiana, Florida, and Texas. The countries raising most of the world's sugar cane are Cuba, Hawaii, Puerto Rico, the Philippines, India, and the East Indies.

*Sucrose from Sugar Cane.* The thick stems of the sugar cane, after harvesting, are stripped of leaves. In the sugar factory the stems are crushed and shredded between toothed rollers. The juice of the crushed stems is extracted in mills consisting mainly of a system of rollers, often nine or twelve in number, through which the shredded material passes. This process is called *grinding*. During grinding, hot water is sprayed over the crushed material to dissolve out some of the contained sugar. The solid, pulpy material remaining after extraction of the juice is known as *bagasse* and is dried and used as fuel. Lime is added to the raw juice drawn from the mill and the mixture is heated to boiling; during this heating unwanted organic acids form insoluble compounds with the lime which can be filtered off along with other solid impurities. Often the juice is treated with gaseous sulfur dioxide to bleach it and is then passed through filter presses. The clear juice is then evaporated in a partial vacuum until it forms a thick sirup containing many crystals of sugar. The dense mass of crystals and sirup is known as *massecuite*. The massecuite is placed in a centrifuge turning at a rate of one thousand to fifteen hundred revolutions a minute; the centrifuge walls are pierced by small holes through which the sirup is forced out during centrifuging. The sirup is known as *molasses*; the yellowish or brown sugar removed during the centrifuging process is called *first sugar*. The first sugar is sprayed with water to remove any molasses which may cling to the crystals and is then removed to the refinery. The molasses may be boiled again and re-evaporated in an attempt to crystallize out some of the rich sucrose content of this liquid; in modern cane-sugar manufacture, usually only one crystallization from sirup is performed. The molasses is a valuable by-product of the sugar industry, being used in the manufacture of rum, as a table sirup, as food for



Canadian National Railways

*Above: Vats in which maple sugar is processed in a factory in Plessisville, Quebec. Left: Testing the sap of a maple tree.*



farm animals, and in the manufacture of several processed tobaccos. The first sugar is sometimes marketed directly as *brown sugar*, which is used in baking; usually, however, it is redissolved in the refinery, is decolorized, and is recrystallized into crystals of desired size. Powdered, granulated, and lump sugar are produced in the refineries.

**Sucrose from Sugar Beets.** The roots of the sugar beet are used in cane-sugar manufacture, the leaves and tops being removed after harvesting and used as stock feed. The roots are cut into *cosettes* or chips at the sugar factory, and the cosettes are crushed to remove the juice. The pulp remaining after the juice extraction is a rich food for domestic animals. After extraction, lime is added to the juice and the remainder of the process is very similar to sugar production from sugar cane. Beet molasses is fed to livestock; no table molasses is made from beets because of difficulties in purification. The "cane sugar" derived from sugar beet is identical with the cane sugar derived from sugar cane.

For sugar derived from the sugar maple, see **MAPLE SUGAR**.

**Sugar Research.** The peacetime production of sugar is much greater than is warranted by consumer demand. Such countries as Cuba and Puerto Rico, which derive their

principal income from the sugar-growing industry, are severely straitened economically by the low price of sugar in peacetime. Various international sugar-control commissions have been set up during the 20th century to supervise the production and export of world sugar in order to maintain minimum sugar prices without working hardship on the eventual consumer. The demand for sugar in wartime, however, is much greater than the supply because of the use of sugar in the munitions industry, and because of difficulties in transport. The United States Department of Agriculture engaged in extensive research during World War II in efforts to discover techniques by which American sugar-beet producers could increase their production. By 1950, the world sugar supply had almost caught up with the vast consumer demand created during World War II, and the more efficient methods of sugar-crop growing developed during the war were expected to increase normal, excessive, peacetime sugar production.

The Sugar Research Foundation, formed in 1943, finances research in new uses for sugar and awards annual prizes for the most significant research developments in sugar chemistry. The discovery of new uses for the by-products of the sugar industry is also encouraged by the foundation.

**SUGAR AND MOLASSES ACT**, one of a number of legislative acts, known as Navigation Acts, which were passed in the 17th and 18th century by the Parliament of Great Britain for the purpose of profitably controlling the industry and commerce of the English colonies on the North American continent. In the 17th and first third of the 18th century the inhabitants of the thirteen English colonies along the Atlantic seaboard imported molasses from the islands of the West Indies; the largest importers were the New England colonies, which used molasses for their highly profitable business of manufacturing rum. Some of the West Indies, such as Barbados and Jamaica, belonged to England; others, such as Saint Domingo and Martinique, to Spain or France. The colonists bought their molasses from either the English or foreign sugar planters. In order to obtain a monopoly of the molasses trade, the sugar planters of Barbados and Jamaica induced the British Parliament to tax heavily any molasses imported into the North American colonies from colonies belonging to any foreign power; and in 1733 Parliament passed the Sugar and Molasses Act, which

imposed a duty of threepence per gallon on foreign molasses.

The Act was designed to force the northern colonies either to buy of English planters or give up the manufacture of rum. The colonists protested vainly against the Act, and thereafter ignored it, smuggling in the necessary supplies of molasses from the French and Spanish West Indies. In 1763 Massachusetts alone illegally imported 15,000 hogsheads of molasses from the French West Indies. The smuggling trade, out of which dealers and shipowners made large fortunes, flourished for thirty years, during which the British government made few attempts to enforce the provisions of the Sugar and Molasses Act. In 1764, however, George Grenville, who became prime minister in that year, initiated a policy of strict enforcement of the Sugar and Molasses and other Navigation acts. His policy was one of the causes of the American Revolution (see REVOLUTION, THE AMERICAN).

**SUGAR BEET** (*Beta vulgaris*), a biennial herb of the family Chenopodiaceae, botanically the same species as the garden beet, important as the source of about two fifths of the world's supply of sugar. The sugar beet flourishes upon a rich, deep, loamy soil in a climate having a mean temperature of about 70° during the growing season. The seed is planted and the crop cultivated and harvested generally by means of implements and machinery. The rotation of the crop with others is carefully planned and the proper fertilization of the fields has been a subject of much study. In commercial beet-seed production beet with about 15 percent sugar are selected, placed in pits during the winter, and set out again in the spring to produce the seed crop.

In the United States, California leads in production of beet sugar. Colorado, Idaho, Michigan, Nebraska, and Montana are other important producers.

**SUGAR CANE**, common name applied to any of the perennial herbs constituting the genus *Saccharum*, belonging to the Grass family. The genus, which contains about twelve species, is native to tropical countries; the common sugar cane, *Saccharum officinarum*, is extensively cultivated in tropical and subtropical countries throughout the world for the sugar contained within its many-jointed stems; see SUGAR. Sugar cane grows to a height of from 8 to 20 feet and has stems from 1 to 2 inches thick. The small spikelets are borne in panicles and are sur-

rounded by long, silky fibers. Several horticultural varieties are known, differing in the color and height of the stem. The common sugar cane has been cultivated from stem cuttings since prehistoric times; some varieties do not produce fertile seed. Cane grown in s. United States is usually planted in the winter, and remains in the ground approximately eight months before being harvested. In tropical countries such as Hawaii and Cuba, cane has a growth period of from one year to eighteen months, and is harvested from January to August. Although several cane-cutting machines have been used with some success, most of the world's sugar cane is harvested by hand. The cutting instrument most commonly used consists of a large steel blade about 18 inches long and 5 inches wide, equipped with a small hook on the back, and set into a wooden handle. Cane is cut at or near the surface of the ground, stripped of its leaves by the knife hook, and trimmed at the top near the last mature joint. The cane is then piled in rows along the ground until picked up by hand or machine, tied in bundles, and transported by cart or truck to the sugar factory. At the factory, the bundles are delivered, usually by mechanical carriers, to the grinding mill, which extracts the sugar from the cane; see SUGAR: *Sucrose from Sugar Cane*.

**SUGAR, METABOLISM OF.** Carbohydrates, one of the three principal constituents of food, form the bulk of the average human diet. The end product of the digestion and assimilation of all forms of carbohydrate is a simple sugar, glucose, commonly called grape sugar when found in food, or blood sugar when found in the human body. The metabolism of fats and of certain protein substances also sometimes leads to the production of glucose. Glucose is the principal fuel which the muscles and other portions of the body consume to produce energy. It is present in every cell and almost every fluid of the body, and its concentration and distribution are among the most important factors in human physiology. A few other sugars are of comparatively minor importance in human physiology, notably lactose (q.v.), which is formed in the mammary glands of nursing mothers.

**Digestion, Assimilation, and Storage.** Carbohydrates such as starch, dextrin, glycogen (animal starch), sucrose (cane sugar), maltose (malt sugar), and lactose (milk sugar) are broken down in the digestive tract into simple, six-carbon sugars which pass easily

through the intestinal wall. Fructose (fruit sugar) and glucose are unchanged in the digestive tract, and are absorbed as such. Cellulose, a common constituent of many foods, is an important nutritional element for some animals, notably cattle and termites, but is not utilized in the human body.

The digestion of carbohydrates is performed by various enzymes. Ptyalin, found in saliva, breaks starch, dextrin, and glycogen into maltose, a twelve-carbon sugar. Amylase, an intestinal enzyme, performs the same function. Other sugar-converting enzymes in the small intestine break twelve-carbon sugars into six-carbon sugars. Maltase breaks maltose into glucose; sucrase or invertase breaks cane sugar into glucose and fructose; lactase breaks milk sugar into glucose and galactose.

The six-carbon sugars which are the end products of carbohydrate digestion pass through the wall of the small intestine into minute blood vessels, and thence into the portal vein which carries them to the liver. In the liver they are all converted into a single compound, glycogen, which is stored there. This glycogen is available at all times, and is converted to glucose and released into the blood stream as required by the body. One of the end products of glucose metabolism in the muscles is lactic acid, which is carried by the blood stream back to the liver and reconverted into glycogen.

**Enzymes and Hormones.** The interconversion between glucose and glycogen is controlled by the presence of minute amounts of several substances, the most important of which is an enzyme called *hexokinase*. Hexokinase specifically controls the reaction of glucose with adenosine triphosphate to form a compound called glucose-6-phosphate. This reaction is a necessary step in the conversion of glucose into glycogen, or in the consumption of glucose as a fuel, and takes place normally in the liver and in all muscle cells. Hexokinase is normally present in liver and muscle cells, but its action is inhibited by the presence of a hormone secreted by the anterior pituitary gland; on the other hand, insulin, a hormone secreted in the pancreas, counteracts the inhibiting tendency of the pituitary hormone. Cortical hormone, adrenalin, and thyroxin are also involved in the complete metabolism of glucose. When any interruption takes place in this complex chemical cycle, the metabolism of sugar in the body is interfered with.

**Glycemia and Glycosuria.** If there is too much pituitary hormone or too little insulin,



the amount of sugar in the blood rises abnormally, producing a condition known as *hyperglycemia*. A pint of blood normally contains about 1/40 ounce of sugar; in hyperglycemia it may contain as much as 1/10 ounce. Hyperglycemia in itself is not lethal, but it is an important symptom of a serious disease, diabetes (q.v.). Diabetes is frequently caused by a tumor or other condition in the pancreas which prevents the formation of insulin. Diabetic patients do not die of hyperglycemia; but if they are not given injections of insulin they may die from such causes as accumulation in the body of poisons produced by altered metabolism of fats; the body of the diabetic consumes fats as a substitute for the sugar which it cannot utilize.

If an excessive amount of insulin is injected into the body, the amount of sugar is reduced to a dangerously low level, a condition known as *hypoglycemia*, and sometimes called *insulin shock*. Controlled insulin shock is sometimes used in the treatment of certain types of insanity.

In a normal individual, if the amount of sugar in the blood rises abnormally, the excess sugar is removed from the blood by the kidneys and excreted in the urine. The presence of sugar in the urine is called *glycosuria*, and although it is an important symptom of diabetes, it is not always found in diabetic patients; moreover, glycosuria may appear in normal individuals immediately after a large meal. The critical test for diabetes is neither hyperglycemia nor glycosuria, but blood sugar tolerance. After ingesting sugar both normal and diabetic individuals show an increased percentage of blood sugar; the percentage remains high in the diabetic, whereas in the normal individual the excess glucose is rapidly converted into glycogen.

**Fermentation.** The chemical reaction whereby plants such as yeast utilize sugar is remarkably similar to the metabolism of sugar in the human body. Yeast secretes a mixture of twelve enzymes, collectively known as *zymase* (q.v.). Most of these enzymes, including hexokinase, are identical to enzymes involved in the human metabolism of glucose. The principal difference occurs at the end of the chain of reaction; a glucose-decomposition product called *pyruvic acid* is converted in the body into lactic acid, but in plants is converted by zymase into ethyl alcohol. See **FERMENTATION**.

Many problems in the physiology of sugar remain to be solved. Present work in this field has been accelerated since the discovery

of tracer elements, especially radioactive carbon. Sugars, synthesized with radioactive carbon, can be followed through the body after ingestion.

**SUGER**, ABBÉ DE SAINT-DENIS (1081-1151), French churchman, statesman, and historian. He spent a large part of his youth in the abbey of Saint-Denis and was for a time a student with Prince Louis, afterward Louis the Fat, with whom he always remained on terms of close friendship. In 1122 he became abbé of Saint-Denis, and he carried out many reforms and greatly increased the prosperity of his charge. He was frequently engaged in affairs of state, and when Louis VII went on the Second Crusade, Suger acted as regent in his absence and administered the affairs of the kingdom with great ability. Shortly afterward, although he had opposed the previous one, Suger preached another crusade, but died in 1151 before it could be carried out. He wrote in Latin a *Life of Louis VI* (1140?), which is one of the chief sources upon the history of the period.

**SUICIDE**, in law, *jelo de se*, the intentional taking of one's own life. Among uncivilized peoples suicide is by no means unknown, though generally regarded as uncommon. It is favored by the teaching of some Oriental religions, but expressly forbidden by the Roman Aristotle condemned suicide as unmanly. The Romans, also affected by Stoic doctrine, recognized many legitimate reasons for suicide and punished with confiscation of property only suicides committed to escape punishment for a grave crime. To St. Augustine suicide was essentially a sin, and several church councils, from the 5th century, deprived the corpse of the ordinary rites of the church. Medieval law usually provided confiscation of the suicide's property, while custom decreed indignities to the corpse, such as dragging by the heels face downward, as in France, or burying at the crossroads with a stake through the body, as in England. Later English law compelled forfeiture of lands and goods in all cases of suicide, but the requirement came to be frequently evaded through the granting of a coroner's verdict of insanity, and the law itself was abolished in 1870. A statute of 1823 made it legal to bury suicides in consecrated ground, but it was not till 1882 that religious services were expressly permitted. In France at the present time neither suicide nor attempt at suicide is punishable.

In the United States suicide is unlawful in

many States, and an unintentional killing of another during an attempt at self-destruction is homicide. An attempt at suicide is a common-law misdemeanor, and in some States a felony by statute. In New York, aiding a suicide is manslaughter in the first degree, and the attempt itself by a sane person was a crime until the law was repealed, effective Sept. 1, 1919.

Social causes often cause a marked increase in the suicide rate. This occurred, for instance, among young people in Germany after World War I.

**SUIDAE**, or SWINE FAMILY, a family of even-toed, nonruminant mammals which, with the Hippopotamus and Peccary (qq.v.) families, constitutes the subdivision Suina of the order Artiodactyla (q.v.). Suidae contains the domestic hogs (q.v.) and also contains several wild species, chiefly distributed in the tropical countries of the Old World. The best known of the latter is the wild boar, *Sus scrofa*, of Europe, s.w. Asia, and n. Africa, from which domestic hogs are descended. Several less important species of wild boars in the genus *Sus* exist in the East Indies. See also BABIRUSSA; BUSH PIG; WART HOG.

**SUIDAS**, a Greek lexicon compiled probably about the middle of the 10th century A.D.; the title is often used for the name of the author, a Greek lexicographer of Constantinople, whose real name is unknown. The material in the lexicon was derived in part from earlier lexicons and in part from scholia (see SCHOLIASTS) and commentaries on early Greek writers, such as Homer, Sophocles, and Aristophanes. The work is valuable for its many quotations from ancient writers and for the information it contains on ancient history and literature.

**SUI JURIS**, a Latin phrase employed to describe a person competent to perform legal acts. The meaning of the phrase has been extended in modern times to denote a person who is capable of taking care of himself. Thus a minor or an insane person is designated in law as a person non sui juris.

**SUIT**, in law, any proceeding in a court of justice brought for the purpose of obtaining a specific remedy by way of damages or other relief.

**SUITE** or **PARTITA**, the earliest type of musical composition containing a series of discrete sections, or movements. The suite was developed in the 16th century as a series of dance tunes, usually composed in one key.

These tunes were so arranged as to present strong contrasts between slow and fast tempos and dignified and gay moods. The four basic movements of the classical suite are: the allemande (Fr., "German"), a quiet dance in moderate tempo, composed in common time; the courante (Fr., "running"), a lively dance, often complex in its rhythms; the sarabande, a stately dance of Spanish origin in triple time, rich in harmonic embellishment; and the jig or gigue, a rapid and lively dance, also in triple time. A prelude, not derived from any dance form, was later customarily included at the beginning of the suite, and one or more additional dance forms, such as the minuet, gavotte, bourrée, chaconne, and passacaglia (qq.v.), were also sometimes inserted, generally between the saraband and gigue. The classical suite reached its perfection in the examples by the German composer Johann Sebastian Bach (q.v.). In the 18th and 19th centuries the classical suite gradually merged with and was superseded by the sonata (q.v.). Modern compositions called suites are only loosely related to the original form; they are primarily symphonic works, characterized by considerable freedom of structure and tonality, and cast either in abstract forms or in greatly modified dance forms.

**SUKASAPTATI** (Skr., "70 [stories] of a parrot"), a collection of Sanskrit prose stories, 70 in number, told by a parrot to the wife of a merchant who is away on his travels. She is inclined to be adulterous, and consults the parrot regarding her plans. The bird pretends to approve of her intentions, but points out to her the dangers of detection, and induces her to promise not to meet any lover unless she can extirpate herself as so-and-so did. This rouses her curiosity, and the parrot tells the story as far as the dilemma, when he asks her what, in her opinion, the person involved ought to do. Unable to make a suitable guess, she promises to remain at home that night on condition that the parrot will tell her the answer the following evening. In this way 70 days pass until her husband returns. The story is very popular in India and has been translated into Persian as the *Tūtīnāmdh*. The *Sukasaptati* exists in two recensions.

**SUKHAYATI** (Skr., "blissful"), the land of bliss into which those Buddhists who believe in Amitabha Buddha, are supposed to be reborn, the Buddha of boundless light, life, and mercy, invented by the founders of the Northern or Mahayana School. It is situated

in some far distant world separated from this world by tens of millions of Buddha worlds, and is presided over by Amitabha. Here there is no difference between gods and men. There is no sin, no hunger, nor pain of any kind, and neither summer nor winter, no day, no night. To attain to this paradise good deeds in this life are not necessary. Simple trust in the mercy of Amitabha is sufficient. Among the common people this doctrine has superseded the doctrine of Nirvana (q.v.).

**SULAIMAN RANGE**, a mountain range in Pakistan, on the boundary between the provinces of West Punjab and Baluchistan. The highest peaks of the range are Kaisargarh (11,316 ft) and Takht-i-Sulaiman, or "the throne of Solomon" (11,070 ft.) The latter takes its name from a cavity, known as Solomon's throne, in the solid rock of the southern end of the mountain.

**SULEIMAN I**, or **II**, known as **THE MAGNIFICENT** (1496?-1566), Sultan of Turkey, succeeding his father, Selim I, in 1520. He invaded Hungary (1521) and captured Schabatz, Semlin, and Belgrade; the following year he drove the Knights of St. John from Rhodes after they had decimated his army by almost 100,000. In 1526 he again led 100,000 men into Hungary, slew King Louis at Mohács (August 29), all but annihilated his army, and captured both Buda and Pesh. By 1529 he was again in Hungary as the supporter of John Zapolva, who claimed the crown against Ferdinand of Austria. Ferdinand was driven back into Vienna, which city the sultan besieged (September to October). After delivering an assault, which cost him 40,000 men, he retreated without taking it. He next directed his arms against Persia, and conquered (1541) large districts, including the cities of Tabriz and Baghdad. In 1535 Suleiman concluded with Francis I the famous treaty which opened the commerce of the Levant to the French flag alone. In 1542 the combined French and Turkish fleets ravaged the Italian coasts and pillaged Nice. The Turks were now supreme in the Mediterranean; in 1551 Tripoli fell into their hands. A second and third war with Persia, now in a state of semisubjugation, a brilliant naval victory (1561) over the Knights of Malta and their allies, the Spaniards, an unsuccessful siege of Malta (1565), and a tresh expedition to Hungary (1566), were the chief events of the remainder of Suleiman's reign.

**SULEIMAN PASHA** (about 1840-92), Turkish marshal. He fought in the early

Russo-Turkish War, and defeated General Gufko at Eski-Zaghra (July 31-Aug. 1, 1877). At Philippopolis, Jan. 15-17, 1878, he met defeat, and was sentenced to imprisonment but later pardoned.

**SULFA DRUGS**, common name applied to a group of chemotherapeutic agents (see **CHEMOTHERAPY**) effective against a number of infectious diseases. In 1935 the German chemist Gerhard Domagk (q.v.), discovered that an azo dye, prontosil, cured streptococcal infections in mice. The active principle in prontosil was found to be para-aminobenzenesulfonamide, commonly known as "sulfanilamide." Clinical trials with sulfanilamide proved effective in arresting various bacterial diseases; the drug does not kill bacteria but inhibits their growth and reproduction. Sulfanilamide is a white, crystalline powder which melts at 165°C. (329°F.). It is soluble in acetone, glycerine, hydrochloric acid, and boiling water, and is insoluble in chloroform, ether, and benzene. Among the derivatives of sulfanilamide which have proven effective against such conditions as bacteremia, puerperal fever, scarlet fever, erysipelas, meningitis, and pneumonia are sulfapyridine, sulfathiazole, sultadiazine, sultaguanidine, sulfamerazine, and sulta-oxidine. All of the sulfa drugs are somewhat toxic, producing blood abnormalities and kidney damage when indiscriminately used. Since the discovery of penicillin (q.v.), which is as effective as the sulfa drugs though far less toxic, the use of the sulfa drugs has somewhat declined. Because patients often develop resistance to the therapeutic effects of either penicillin or sulfa drugs, both agents are in common use.

**SULFATING**, a white deposit of lead sulfate that appears on the plates of an accumulator when it is left uncharged for a long period.

**SULFONAL**, a white crystalline compound used as a hypnotic. It is of highly complex composition, with the formula  $(\text{CH}_3)_2\text{C}(\text{SO}_2\text{C}_2\text{H}_5)_2$ . It forms colorless, tasteless crystals, very slightly soluble in cold water.

**SULFUR**, or **BRIMSTONE**, a nonmetallic element of atomic number 16, atomic weight 32.06, and symbol S, known since prehistoric times and mentioned in the Bible and early classical records. Because of its inflammability, it was regarded by the alchemists as the secret factor in the principle of combustion. Sulfur ranks twelfth in abundance among the elements in the earth's crust, and is found widely distributed in both the free and combined state. In combination it occurs

in many important metallic sulfides such as lead sulfide or galena,  $\text{PbS}$ , zinc blende,  $\text{ZnS}$ , copper pyrite,  $\text{CuFeS}_2$ , cinnabar,  $\text{HgS}$ , stibnite,  $\text{Sb}_2\text{S}_3$ , and pyrites (q.v.),  $\text{FeS}_2$ . It is also combined with other elements in the form of sulfates such as barite,  $\text{BaSO}_4$ , celestite,  $\text{SrSO}_4$ , and gypsum,  $\text{CaSO}_4$ , and is a constituent of many organic substances such as mustard, eggs, hair, proteins, and oil of garlic. In the free state it is found mixed with gypsum and pumice stone in volcanic regions throughout Iceland, Sicily, Mexico, and Japan, often occurring as a sublimate surrounding the volcanic apertures. Vast subterranean deposits are found in this country in many parts of Louisiana and Texas, as well as in Colorado, Nevada, Wyoming, and California. Free sulfur may be formed from the weathering of pyrites or may be deposited by hot sulfureous waters in which the sulfuretted hydrogen has been oxidized by the atmosphere.

Sulfur is a tasteless, odorless, light-yellow solid, insoluble in water but readily soluble in carbon disulfide. Ordinary sulfur melts at  $114.5^\circ\text{C}$ . ( $238.1^\circ\text{F}$ .), forming a straw-colored liquid which turns darker with additional heating and which finally boils at  $444.6^\circ\text{C}$ . ( $832.3^\circ\text{F}$ .). When molten sulfur is slowly cooled, its physical properties change in accordance with the temperature, pressure, and method of crust formation. It thus exists in various forms called *allotropic* modifications which consist of two solid varieties, *rhombic* and *monoclinic*, and two liquid varieties, *S<sub>A</sub>* and *S<sub>B</sub>*. The most stable variety is rhombic sulfur, a yellow, crystalline solid with a specific gravity of 2.06 and a melting point of  $112.8^\circ\text{C}$ . ( $235.0^\circ\text{F}$ .). It is slightly soluble in alcohol and ether, moderately soluble in oils, and extremely soluble in carbon disulfide. When kept at temperatures above  $96^\circ\text{C}$ . ( $204.8^\circ\text{F}$ .) but below  $119^\circ\text{C}$ . ( $246^\circ\text{F}$ .) the rhombic form changes into monoclinic sulfur consisting of long, transparent, needlelike structures having a specific gravity of 1.96 and melting at  $119^\circ\text{C}$ . The temperature at which rhombic and monoclinic sulfur are in equilibrium,  $96^\circ\text{C}$ ., is called the *transition temperature*. When ordinary sulfur is melted at  $114.5^\circ\text{C}$ ., it forms the mobile, pale-yellow liquid *S<sub>A</sub>* sulfur, which becomes dark and viscous at  $160^\circ\text{C}$ . ( $320^\circ\text{F}$ .) to form  $\mu$  sulfur. If sulfur heated almost to the boiling point is poured rapidly into cold water it does not have time to crystallize into the rhombic or monoclinic state, but forms a transparent, sticky, elastic substance known as *plastic*

*sulfur*, which consists for the most part of supercooled  $\mu$  sulfur.

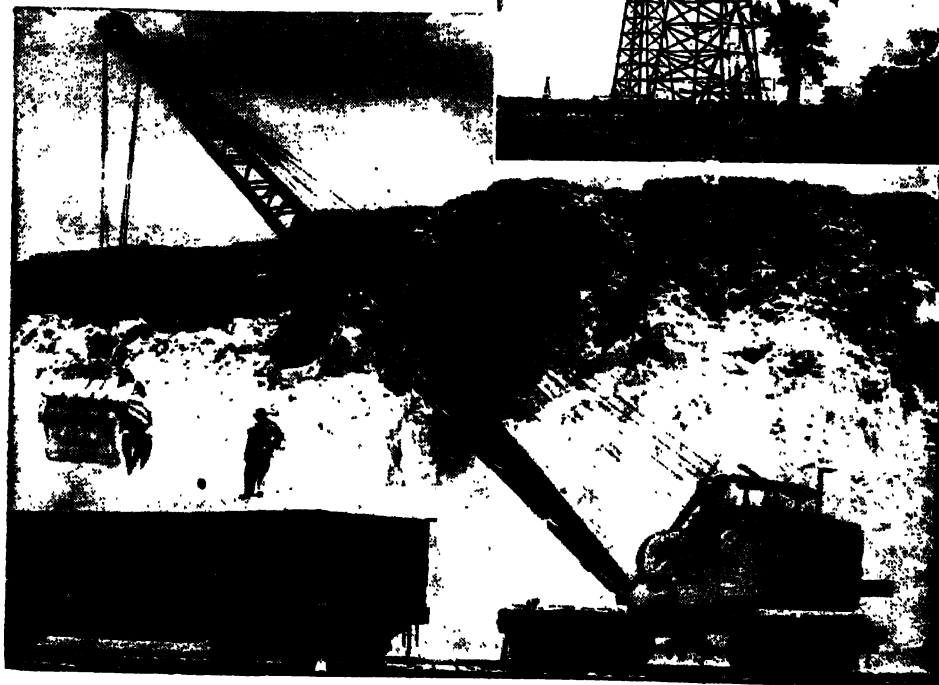
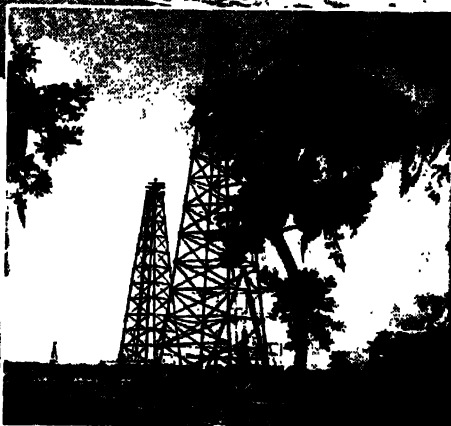
**Extraction.** Several methods exist for the extraction of free sulfur from the earth. In Sicily the sulfur-containing rock is placed in large piles on sloping ground and ignited. The liquid sulfur resulting from this heating is allowed to run into a series of wooden molds, in which it solidifies and is known as *roll sulfur*. The roll sulfur may be further purified through distillation, the vapor being passed into a large brick chamber in which it condenses on the walls as a fine powder called *flowers of sulfur*. In areas where natural sulfur deposits lie 900 or more feet below the surface of the earth, as in Louisiana and Texas, the method most commonly used for extraction is the *Frasch process*, invented by the American chemist Herman Frasch (q.v.). In this method four concentric pipes, the largest being 8 inches in diameter, are driven down into the sulfur-containing deposits. Water, heated under pressure to  $170^\circ\text{C}$ . ( $338^\circ\text{F}$ .), is forced through the two outer pipes into the deposit, melting the sulfur. When a sufficient quantity of sulfur has been melted, hot air is forced down the innermost pipe to form a froth with the molten sulfur, and the mixture is forced up to the surface through the remaining pipe. The sulfur is run into wooden bins and solidified, yielding a product which is about 99.5 percent pure. Sulfur is also obtained from pyrites by distillation in iron or fire-clay retorts, but usually contains traces of arsenic when produced in this manner.

Sulfur has valences of two, four, and six, as evidenced by the compounds ferrous sulfide,  $\text{FeS}$ , sulfur dioxide,  $\text{SO}_2$ , and barium sulfate,  $\text{BaSO}_4$ , respectively. It combines with metallic elements in the presence of heat to form sulfides, the most important of which is hydrogen sulfide,  $\text{H}_2\text{S}$ , a colorless, poisonous gas with the odor of rotten eggs. It combines also with chlorine in several proportions to produce sulfur monochloride,  $\text{S}_2\text{Cl}_2$ , and sulfur dichloride,  $\text{SCl}_2$ . When burned in air, sulfur combines with oxygen to form sulfur dioxide,  $\text{SO}_2$ , a heavy, colorless gas with a characteristic, suffocating odor. In moist air it is slowly oxidized to sulfuric acid (q.v.), and is a basic constituent of other acids such as sulfurous acid,  $\text{H}_2\text{SO}_3$ , and thiosulfuric acid,  $\text{H}_2\text{S}_2\text{O}_3$ . The latter has two replaceable hydrogens and forms two series of salts; normal and acid sulfites. The acid sulfites or bisulfites of the alkali metals, such as sodium bisulfite,  $\text{NaHSO}_3$ , when in solution, are acid



Texas Gulf Sulfur Co.

OBTAINING SULFUR. Above: Molten sulfur being discharged on storage mound. The sulfur solidifies and gradually increases height of the mound. Right: Derricks of sulfur wells. Below: Loading sulfur from face of a mound.



in reaction. Solutions of the normal sulfites, such as sodium sulfite,  $\text{Na}_2\text{SO}_3$ , and potassium sulfite,  $\text{K}_2\text{SO}_3$ , are alkaline.

**Uses.** The most important use of sulfur is in the manufacture of sulfur compounds, such as sulfuric acid, sulfites, sulfates, and sulfur dioxide, all mentioned above. Medicinally, it has assumed great importance because of its widespread use in the so-called sulfa drugs (q.v.) and in many skin ointments. A gray or pale-yellow powdered sulfur, obtained as a precipitate from the reaction of a polysulfide with an acid, is used as a laxative, and is known as *milk of sulfur*. Sulfur is employed in the production of matches, vulcanized rubber, and gunpowder. In a finely divided state and, frequently, mixed with lime, it is used as a fungicide on plants. The salt, sodium tetrathiosulfate,  $\text{Na}_2\text{S}_4\text{O}_6$ , commonly called "hypo", is used in photography for "fixing" negatives and prints. Combined with various inert mineral fillers, sulfur forms a special cement used to anchor metal objects, such as railings and chains, in stone.

In a recent year, more than 5,500,000 long tons of sulfur were extracted by various methods in the United States, and were valued at approximately \$100,000,000.

**SULFUR BOTTOM**, common name applied to the blue whale, *Sibbaldus musculus*; see FINBACK.

**SULFURIC ACID**, or OIL OF VITRIOL, a corrosive, oily liquid, formula  $\text{H}_2\text{SO}_4$ , colorless in the pure state but commonly appearing straw colored to dark brown. It is a heavy liquid, with a specific gravity of 1.8, b.p.  $330^\circ\text{C}$ . ( $626^\circ\text{F}$ .) and is completely soluble in water. Sulfuric acid has been commercially important for hundreds of years. The early alchemists prepared it in large quantities by heating naturally occurring sulfates to a high temperature and dissolving in water the sulfur trioxide thus formed. About the 15th century a method was developed of obtaining the acid by distilling hydrated ferrous sulfate, or iron vitriol, with sand. In 1740, the acid was produced successfully on a commercial scale by burning sulfur and potassium nitrate in a ladle suspended in a large glass globe partially filled with water. During the 19th century, the German chemist Baron Justus von Liebig discovered that sulfuric acid, when added to the soil, increased the amount of soil phosphorus available to plants. This discovery necessitated an increase in the commercial production of sulfuric acid, and led to improved methods of manufacture.

Two processes are in use today for the commercial production of sulfuric acid. Both require in their initial steps the use of sulfur dioxide, which is produced by burning iron pyrites,  $\text{FeS}_2$ , or sulfur in air. The first of these methods, the *lead-chamber process*, employs the use of two lead chambers, flanked on each side by lead-sheathed brick towers, called Glover towers, packed with coke or some other absorbing material. Sulfur dioxide and water are allowed to pass from burners into a Glover tower, in which they are cooled and mixed with nitrogen oxides. The gaseous mixture of sulfur dioxide and nitrogen oxides then enters the first chamber. Steam and air are introduced and sulfuric acid is formed as fine droplets which fall to the bottom of the chamber. Gas which is not condensed in the first chamber passes into the second chamber, in which a similar bath of steam and air completes the process. One of the flanking towers serves to recover the reduced and unused nitrogen oxides. Sulfuric acid produced in this way, and labeled *chamber acid*, is only about 62 to 70 percent pure. Further evaporation yields the commercial, concentrated form, which is about 65 percent pure.

In the second method of preparation, the *contact process*, sulfur dioxide is carefully purified and washed; it is then mixed with air and passed into a catalytic chamber lined with platinum or platinized asbestos. There the sulfur dioxide is heated to about  $400^\circ\text{C}$  ( $752^\circ\text{F}$ ) and oxidized to form sulfur trioxide. The trioxide is next passed into water, and the resulting mist or fog, consisting of sulfuric acid droplets, is absorbed in concentrated sulfuric acid. The resulting solution is maintained at a concentration of 97 to 99 percent by a regulated influx of water. Fuming sulfuric acid, also called *oleum*, or *Nordhausen acid*, is prepared by dissolving sulfur trioxide in concentrated sulfuric acid. Its strength is expressed as the percentage of sulfur dioxide not combining with water to form sulfuric acid.

Chemically, sulfuric acid is a diacid; i.e., each molecule contains two active acid hydrogen atoms. In dilute solution it is stronger than sulfurous acid, but weaker than hydrochloric acid,  $\text{HCl}$ , and nitric acid,  $\text{HNO}_3$ . The anhydrous acid, hydrogen sulfate, combines readily with water to form a series of hydrates, the most common of which are monohydrated, or 100 percent sulfuric acid,  $\text{H}_2\text{SO}_4\cdot\text{H}_2\text{O}$ , and dihydrated, or glacial, sulfuric acid,  $\text{H}_2\text{SO}_4\cdot\text{H}_2\text{O}\cdot\text{H}_2\text{O}$ . Hot, concen-

trated sulfuric acid is a powerful oxidizing agent, and when combined with such metals as copper or mercury will produce sulfur dioxide and a metallic sulfate. Sulfuric acid forms both acid and normal salts. The acid salts are called bisulfates, or acid sulfates; the normal salts are called sulfates. Sulfates of barium, strontium, calcium, and lead occur in nature as the minerals barite, celestite, gypsum, and anglesite (qqv), and may be prepared in the laboratory by precipitation.

Many industries are dependent upon sulfuric acid, which plays an important role in countless numbers of processes. In the manufacture of fertilizer, it is used to produce ammonium sulfate and soluble phosphates. It is also used in petroleum refining to remove unsaturated compounds from crude oil; in the manufacture of other important acids such as hydrochloric and nitric acid (qv); in the production of coal tar products such as dyes, drugs, and disinfectants; in the processing of steel; and to absorb excess water in the manufacture of explosives such as nitroglycerine, gun cotton, and trinitrotoluene.

In a recent postwar year, production of sulfuric acid by all methods totaled approximately 13,340,000 short tons. See also SULFUR.

**SULINA**, the central arm of the delta of the Danube. Though not the largest in volume, it has been made navigable for the largest vessels.

**SULIOTES**, a tribe of Turkish subjects of mixed Greek and Albanian blood, who derived their name from the Suli Mountains, near Parga, in Epirus, to which they fled from the Turks in the 17th century. Their persistent opposition to Turkish rule brought them into constant trouble and won for them a reputation for bravery and patriotism. Overcome in 1803 by Ali Pasha of Janina, they left their mountains and fled to the islands off their native shore. From here the Suliotes were driven by the sultan to their old mountain retreats and to the island of Cephalonia. Later they are found warring on the side of Greek independence, their most celebrated leader being Marco Bozzaris.

**SULKY**. See CART.

**SULLA**, a perennial leguminous fodder plant, *Hedysarum coronarium*, native of southern Italy and similar Mediterranean regions, where it has been in cultivation since about 1766. It is a leafy plant 4 to 6 feet tall, bearing numerous clusters of pink flow-

ers; the flowers are known as French honeysuckle.

**SULLA**, LUCIUS CORNELIUS, surnamed by himself FELIX (138-78 B.C.), Roman general and statesman, and the bitter opponent of Gaius Marius (qv). Sulla was descended from the illustrious family of the Corneli. As quaestor in 107 B.C. under Marius in Africa, he induced Bocchus, King of Mauretania, to surrender Jugurtha (qv), King of Numidia whom he brought in chains to the Roman camp in 106 B.C. In the campaigns of 104 to 101 B.C. against the Cimbri and the Teutones, Sulla continued his martial successes. In 93 B.C. he was praetor, and the following year propraetor, in Cilicia. In 88 B.C., after having won acclaim for his leadership in the Social War (qv) against the Italian allies of Rome, he was made consul. The hopes of Marius, who had coveted the consulship, were again thwarted when the Roman senate bestowed upon Sulla the supreme command of the war against Mithridates VI, King of Pontus. Marius attempted to deprive Sulla of his command, and civil war ensued. After the overthrow of the Marian party and the flight of Marius, Sulla in 87 B.C. went to the East, and by a series of victories forced Mithridates to sue for peace in 83 B.C.

When he returned to Italy he found the Marian party, which had massacred his adherents in his absence, again in revolt, although Marius was now dead. Sulla crushed the power of the Marian party in Italy before the end of 82 B.C., but in Spain supporters of the Marian policy fought out a time under Sertorius (qv). Sulla now had himself appointed dictator. In 81 B.C. came the fearful period of the proscriptions, which wiped out most of those who had been supporters of the Marian party. Sulla's dictatorship was signalized by a complete constitutional reform, designed to restore the ancient power of the senate and the aristocracy. Especially significant was his reorganization of the system of criminal procedure, by the establishment of new *quaestiones perpetuae*, the first permanent courts to be established in Rome. In 79 B.C. Sulla resigned the dictatorship and retired to his estate at Puteoli (now Pozzuoli), where he died shortly afterward.

**SULLIVAN**, county seat of Moultrie Co., Ill., situated about 175 miles S.E. of Chicago. It is served by three railroads. The principal industries in the city are the manufacture of candy, cheese, livestock feeds, dresses, shoes, sashes and doors, tools, machinery, and cul-

vert pipes. Sullivan is the site of the Illinois Masonic Home. Pop. (1950) 3470.

**SULLIVAN**, county seat of Sullivan Co., Ind., situated 26 miles s. of Terre Haute. It is served by three railroads. The city lies in a region noted for the production of poultry, dairy products, coal, oil, and natural gas. The area contains one of the most extensive coal fields in the State. Among the industrial establishments in the city are cheese factories and machine shops. Sullivan was founded in 1842 and incorporated in 1909. Pop. (1950) 5423.

**SULLIVAN**, a city of Crawford and Franklin counties, Mo., situated about 65 m. by rail s.w. of St. Louis. The principal products of the surrounding agricultural area are wheat, fruits, poultry, dairy products, and livestock. The leading industry in the city and vicinity is the manufacture of leather and leather products. A trading post was established on the site of the present city in 1800. Pop. (1950) 3019.

**SULLIVAN**, SIR ARTHUR SEYMOUR (1842-1900), English composer, born in London, and trained at the Chapel Royal, in which he was a chorister from 1854 to 1856, at the Royal Academy of Music, and at the Leipzig Conservatory. His father, who was bandmaster and teacher of clarinet at the Royal Military School of Music, gave Sullivan his earliest musical training. Upon his return from Leipzig in 1861, he was appointed organist at St. Michael's, London, and for the next eleven years he divided his time between his church duties, teaching, and composing. In 1862 his incidental music to Shakespeare's play, *The Tempest*, was performed at the Crystal Palace and established his reputation. Two years later he composed a cantata, *Kenilworth*, produced at the Birmingham festival. To this period also belong a number of symphonic works and considerable church music. Sullivan's greatest success during these years, however, was gained through his songs, especially a group set to poems by Shakespeare and the popular *Onward! Christian Soldiers* and *The Lost Chord*.

Sullivan's first comic opera, *Cox and Box* (1867), revealed a notable talent for this medium. In 1871 he met the playwright William Schwenck Gilbert, and the two men entered into a collaboration, lasting almost twenty-five years, which has rarely been equalled in the history of the theater. Together they produced fourteen comic operas (see GILBERT, SIR WILLIAM SCHWENCK: *Gilbert and Sullivan Operas*), which were

received by the entire English-speaking world with an affectionate enthusiasm that has continued to this day. Musically, the Gilbert and Sullivan operas are generally considered the finest comic operas ever written to English texts. Sullivan had a remarkable gift for musical parody, particularly of such overornate traditions as those of Italian opera and the English Elizabethan madrigal; in addition, he originated new forms of comic musical settings, notably the "patter song", a light tune restricted to a small vocal range in which adroit use is made of a long, rapidly delivered text. Sullivan was conductor of the Leeds Festival from 1879 to 1898. He was knighted in 1883. Among his later works is a *Te Deum* composed for Queen Victoria's diamond jubilee in 1897.

**SULLIVAN**, EDWARD (1832-1902), Canadian Anglican bishop, born in Lurgan, Ireland, and educated at Trinity College, Dublin. Going to Canada in 1858, he was ordained a priest of the Church of England in Canada in 1859, and in 1862 became assistant rector of St. George's Church, Montreal. In 1868-78 he was rector of Trinity Church, Chicago, and in 1878-82 rector of St. George's, Montreal. In the latter year he was appointed Bishop of Algoma, but in 1896 resigned the bishopric and became rector of St. James' Cathedral, Toronto. He belonged to the evangelical school, and attained a wide reputation as a pulpit orator.

**SULLIVAN**, JOHN (1740-95), American military officer and civic official, born in Berwick, Me. During the American Revolution, as brigadier general and later major general in the Continental Army, he held important commands at the siege of Boston (1775-76), the battles of Long Island (1776), Trenton (1776), Brandywine (1777), and Germantown (1777), and led the American forces that besieged Newport (1778). He is particularly noted for his leadership, together with the American general James Clinton, of an expedition that decisively defeated a strong combined force of British Loyalists and Iroquois Indians near Elmira, N.Y. (August 29, 1779). Sullivan resigned his commission in November of that year; served in the Continental Congress (1780-81); was attorney general of New Hampshire (1782-86); president of New Hampshire (1786-89); and United States district judge of New Hampshire (1789-95).

**SULLIVAN**, JOHN L. (1858-1918), American pugilist, born in Boston, Mass. Sullivan became a professional prize fighter in 1878;



in 1882 he won the world's heavyweight championship by knocking out Paddy Ryan, champion since 1880, in the ninth round of a contest fought at Mississippi City, Miss. This contest was fought with bare knuckles under London Prize Ring rules (see PRIZE FIGHTING OR PUGILISM); Sullivan remained the bare-knuckle heavyweight champion of the world until his death. However, in many of the contests in which he engaged after 1882 Sullivan fought with boxing gloves under the Marquis of Queensberry rules (see BOXING) then coming into favor; and in 1892 he fought the American pugilist James J. Corbett to determine the first heavyweight champion of the world under Marquis of Queensberry rules. In this fight, which was held at New Orleans, La., for a purse of \$25,000 and a side bet of \$10,000, Sullivan was knocked out by Corbett in the twenty-first round. Sullivan's last known appearance in the ring was in a benefit contest in 1896. During his career he engaged in thirty-seven matches; he won twelve by knockouts and twenty by decision, drew three, and was knocked out once. His unusual strength earned him the sobriquet "the Boston strong boy"; and his personal popularity, together with adoption of the Marquis of Queensberry rules which eliminated many of the brutal aspects of prize fighting, did much to advance public interest in the sport.

**SULLIVAN, LOUIS HENRI** (1856-1924), American architect, born in Boston, Mass., and trained for a year, in 1872, at the Massachusetts Institute of Technology. In 1873 he moved to Philadelphia and worked in the office of an architect. In 1877 he went to Paris to study at the École des Beaux-Arts; subsequently, he visited Rome. On his return to America in 1876 he settled in Chicago, and worked as an architect with various partners until 1900, when he established an independent practice. Sullivan was one of the great forerunners of modern architecture, particularly in his development of new forms suitable for skyscrapers and other steel-framed buildings. Among his most notable buildings are the Transportation Building at the World's Columbian Exposition (1893), the Bayard Building, New York City (1898), the Gage Building, Chicago (1899), and the Schlesinger and Mayer Department Store, Chicago (1899). He expounded his concept of architecture in *The Autobiography of an Idea* (1924).

**SULLIVAN, MARK** (1874-1952), American journalist and author, born in Avondale, Pa.,

and educated at Harvard University. He was known for his column, appearing in a number of American newspapers including the New York *Herald Tribune*, in which he commented on political events from the standpoint of a conservative Republican; and for *Our Times: the United States, 1900-25* (6 vols., 1926-36), a study of American social and political life of the first quarter of the 20th century. Sullivan was also the author of the autobiography *The Education of an American* (1938).

**SULLIVAN, ROBERT BALDWIN** (1802-53), Canadian statesman and jurist, born in Bandon, Ireland. He went to Canada with his father in 1819, and settled at York (now Toronto). He was called to the bar in 1828, and practiced law in Victoria and later in Toronto. Bred a Liberal, Sullivan soon came to identify himself with the Conservatives. He was elected mayor of Toronto in 1835, and in 1836 was appointed a member of the provincial executive council by the lieutenant governor, Sir Francis Bond Head. He served in the militia during the rebellion of 1837-38, and was appointed a member of the Legislative Council of Upper Canada in 1839. The real test of his ability and character came with the larger issues involved in the Act of Union in 1841 (see CANADA: History). Sullivan was a member of the first administration after this; but because he was a Conservative his presence, with that of others, was objected to by Robert Baldwin, the premier, who resigned. Sullivan remained in office, and in the following administration (1841-43) was president of the council, by accepting which position he apparently repudiated his former political faith. Nevertheless, he soon became more in sympathy with Liberal members of the cabinet and resigned with them upon a serious difference of opinion with the governor-general, Sir Charles Metcalfe. Canada was now virtually without a responsible administration, the country being divided into two parties, those who favored and those who opposed the autocratic Toryism of Sir Charles Metcalfe. Sullivan at this time did the most noteworthy service of his career by a brilliant defense of parliamentary government in a series of letters contributed to the Toronto *Examiner* under the signature "Legion". In a later administration (1848-51) he was provincial secretary for Upper Canada till 1848 and thereafter was a puisne judge of the court of Queen's Bench for Upper Canada. He was described by authoritative writers as prob-

ably the most brilliant man known to the Canadian history of his time. As an orator he was without a rival, but the effect of his eloquence and debating power was somewhat weakened by a lack of steadfast conviction.

**SULLIVAN, THOMAS BARRY** (1824-91), British tragedian, born in Birmingham. He was brought up in Cork, where he made his appearance on the stage before 1840. He joined the company of the Theatre Royal, Edinburgh, and remained there several seasons, advancing rapidly in his profession. In 1852 he appeared at the Haymarket Theatre, London, in Shakespeare's *Hamlet*, the part in which he was on the whole most successful.

**SULLIVAN, TIMOTHY DANIEL** (1827-1914), Irish journalist and legislator, born in Bantry, County Cork. He early wrote for the Dublin newspapers, vigorously advocating Irish Home Rule. Later he became identified with the Land League (q.v.). In 1880, with Charles Stewart Parnell (q.v.) and others, he was arrested and tried in Dublin for his League activities, but was freed by the disagreement of the jury in January, 1881. He became prominent in the Home Rule propaganda, delivering many speeches in Ireland and Great Britain. Between 1880 and 1900 he was a Nationalist member of the House of Commons successively for Westmeath, Dublin City, and West Donegal. He was elected lord mayor of Dublin in 1886 and 1887. In 1888 he was imprisoned for two months in Tullamore jail for publishing reports of branches of the Land League which had been suppressed under the Coercion Act, and in 1889 he was examined before the Parnell Commission. Sullivan's works include *Songs and Poems* (new ed., 1901), *Recollections of Troubled Times in Irish Politics* (1905), and *Bantry, Berehaven and the O'Sullivan Sept* (1908).

**SULLIVAN'S ISLAND**, island at the entrance to Charleston Harbor, the site of Fort Moultrie.

**SULLIVANT, WILLIAM STARLING** (1805-73), American botanist, the founder of American bryology, born in Franklinton, Ohio, and educated at Ohio University and Yale College. In 1840 he compiled a *Catalogue of Plants in the Vicinity of Columbus, Ohio*, and thereafter specialized in the cryptogamous plants. *Musci Alleghanienses* (1845) was followed in 1846 and 1849 by contributions to the *Memoirs of the American Academy of Sciences* "On the Bryology and Hepaticology of North America", and by a valuable

addition to Gray's *Manual* on the mosses of the northern United States, published separately in 1856 as *The Musci and Hepaticae of the United States East of the Mississippi River. Icones Muscorum* (2 vols., 1864-74), containing 129 valuable copper plates, is probably Sullivan's greatest work.

**SULLY, JAMES** (1842-1923), English psychologist, born in Bridgewater, Somersetshire. Until 1892 he served as lecturer at the College of Preceptors, London, and in that year became professor of the philosophy of mind and logic at University College, London. Among his works are *Studies of Childhood* (1895) and *Essay on Laughter: Its Form, Its Causes, Its Development, and Its Value* (1902). He also wrote *Italian Travel Sketches* (1912).

**SULLY, MAXIMILIEN DE BETHUNE, DUKE OF** (1560-1641), minister of Henry IV of France, born in the château of Rosny near Mantes. He attached himself to Henry of Navarre, narrowly escaped the St. Bartholomew Massacre (1572), and accompanied Henry in his flight from court (1576). He took an active part in the war and helped materially to decide the victory, and throughout the whole of the reign remained the king's most trusted counselor. His first task was to repair the finances of the realm.

In February, 1601, he became grand master of the artillery, and in March, 1606, he was created Duke of Sully. After the assassination of his master he was allowed to retain the care of the woods and the artillery, and was even presented by Marie de Médicis with a reward of 300,000 livres. But soon after he retired to his estate.

**SULLY, THOMAS** (1781-1872), American portrait painter, born in Horncastle, Lincolnshire, England, and brought by his parents to Charleston, S. C., in 1792. After a desultory training under a French miniature painter, he removed to New York in 1806. Eventually he settled in Philadelphia. In 1837 he visited England painting the portrait of Queen Victoria for St. George's Society, Philadelphia. Among his best-known portraits are those of Commodore Decatur in the City Hall, New York City; General Lafayette in Independence Hall and George Frederick Cooke in the Pennsylvania Academy of Fine Arts, Philadelphia; and Thomas Jefferson (1821) in the U. S. Military Academy, West Point. He is represented in the Metropolitan Museum of Art, New York City by nine portraits, including those of his wife, daughter, and himself.

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**SULLY-PRUDHOMME, RENÉ FRANÇOIS ARMAND** (1839-1907), French poet, born in Paris. In 1865 he published his first volume of poems, *Stances et Poèmes*. Among his later volumes are *Impressions de la Guerre*, *Les Destins*, *Les Vaines Tendresses*, *La France*, and *La Révolte des Fleurs*. His poems "La Justice" and "Le Bonheur" are considered masterpieces of analytic subtlety.

**SULPHUR.** See **SULFUR**.

**SULPHUR**, a town of Calcasieu Parish, La., situated in the s.w. part of the State, 10 miles w. of the port of Lake Charles (q.v.) and about 50 m. by rail n.e. of Beaumont, Tex. It is surrounded by a rich agricultural and oil-producing area, in which rice, sugar cane, cotton, and corn are the chief crops. Formerly the region contained sulfur mines. Pop. (1950) 5996.

**SULPHUR**, county seat of Murray Co., Okla., situated about 80 miles s.s.e. of Oklahoma City. It is served by rail, and is the gateway to Platt National Park (q.v.), which adjoins the city on the s. The mineral and natural beauty in the park are renowned for their curative properties, and Sulphur is a noted health resort. Within the city are numerous artesian wells, some of which form natural fountains, and several large mineral wells, including Vandome, one of the largest in the world. Veterans Lake within the city covers more than 115 acres and abounds in fish. Sulphur is the site of the Oklahoma School for the Deaf and the Oklahoma Soldiers Tubercular Sanitarium. Pop. (1950) 4389.

**SULPHUR SPRINGS**, county seat of Hopkins Co., Tex., situated 95 miles s.e. of Dallas. It is served by two railroads and maintains a municipal airport. The city is the trading center and shipping point of one of the largest dairying regions of Texas. Cotton, corn, beef cattle, hogs, and poultry are other agricultural products of the area, and clay is a leading mineral product. Among the industrial establishments in the city are extensive milk processing plants, including condenseries and cheese factories, meat-packing plants, cottonseed-oil mills, cotton compresses, and factories manufacturing brick and furniture. Sulphur Springs derives its name from the mineral springs which formerly made the site a health resort. The springs are no longer of commercial importance. Pop. (1950) 8991.

**SULPICIA**, the name of two Roman poetesses. 1. The niece of the general Marcus Valerius Messala (q.v.) Corvinus. Her six

elegiac poems, addressed to a lover named Cerinthus, have been preserved with the poems of Albius Tibullus (q.v.) and were long ascribed to him. They are interesting for their portrayal of the life of a Roman lady in the Augustan Age. 2. A poetess who lived toward the end of the 1st century A.D. and wrote a collection of love poems addressed to her husband Calenus. The one extant poem attributed to her is believed by most scholars to have been written several centuries later.

**SULPICIANUS**, an order of priests for training young men for the church, founded in 1645, and named from the church of Saint Sulpice in Paris.

**SULPICIUS APOLLINARIS, GAIUS** (2nd century A.D.), Roman grammarian and commentator, born in Carthage. He is praised highly in the works of his pupil Aulus Gellius (q.v.). His metrical arguments, or summaries, of the books of the *Æneid* of Vergil, each in six hexameters, and similar summaries of the six comedies of Terence, each in twelve iambic trimeters, are extant.

**SULPICIUS RUFUS**, the name of two Roman orators. 1. **PUBLIUS SULPICIUS RUTUS** (about 121-88 B.C.), orator and statesman. Although he was an aristocrat, in the civil war between Gaius Marius and Lucius Cornelius Sulla (q.v.), he supported the Marian party, and was forced to flee from Rome when Sulla marched upon the city. He was captured soon afterward and put to death. Sulpicius Rutilus was praised highly by the orator Marcus Tullius Cicero for the dignity and clarity of his speeches. 2. **SERVILIUS SULPICIUS RUTUS** (about 106-43 B.C.), orator and jurist, a friend and contemporary of Marcus Tullius Cicero. In the civil war between Gaius Julius Caesar and Pompey the Great, Sulpicius Rufus joined Caesar, who made him proconsul of Achaia in 46 B.C. He died at Mutina (now *Modena*), to which he had been sent by the Roman senate on a mission to Mark Antony (see **ANTONIUS, MARCUS**). Sulpicius Rufus wrote many treatises on Roman law and was often quoted in the *Digest*, compiled in the 6th century A.D. by order of the emperor Justinian.

**SULPICIUS SEVERUS** (about 360-about 410 A.D.), Latin Christian historian, born in Africa. He retired from the practice of law and renounced the world after meeting St. Martin (q.v.), bishop of Tours, whom he frequently visited and whose biography he wrote (*Vita S. Martini Turonensis*). This work and several of his dialogues have great historical value, and his *Historia Sacra*, or

*Chronica*, a brief history extending from Adam to 400 A.D., was used as a textbook in the schools of Europe during the 16th and 17th centuries.

**SULTANABAD**, properly **IRAQ**, city of the w. central part of Iran, situated about 100 miles s.e. of Hamadan, at an elevation of about 6000 ft. above sea level. Transportation facilities include a railroad. Sultanabad is the center of an agricultural area yielding cereal grains and grapes, and is noted for the manufacture of fine rugs and carpets. In the 13th and 14th centuries the Sultanabad area was known for the production of beautiful pottery. Pop., about 55,000.

**SULTE**, **BENJAMIN** (1841-1923), French-Canadian author, born in Three Rivers, in the province of Quebec. Taken from school at the death of his father, who perished at sea, Sulte pushed his way through various employments into journalism and into the service of the government as translator. His prose works include the *Histoire des Canadiens-Français* (1882-84), *Histoire de St. François du Lac* (1886), and *Pages d'Histoire du Canada* (1891).

**SULU** or **JOLO**, the largest island of the Sulu Archipelago, Sulu Province, Philippines, situated about 100 miles s.w. of the s. extremity of Zamboanga Province. Like the other large islands of the archipelago, Sulu is of volcanic origin. Several mountain chains traverse the island in a southwest-northeast direction. The highest peak is 2894 ft. above sea level. Extensive forests occupy the mountain slopes, and the valleys are fertile and well cultivated. Fishing is the principal industry. Exports include pearls and pearl shells. Jolo (pop., about 45,000), the provincial capital, is situated on the n.w. coast. Area, about 330 sq.m.; pop., about 50,000.

**SULU ARCHIPELAGO**, an island group of the Philippines, coextensive with the province of the same name and situated between the Sulu and Celebes seas, s.w. of Mindanao. The s.e. extremity of the group, a long chain extending in a general northeast-southwest direction, lies off the w. coast of Borneo. For the most part the archipelago, which is made up of more than 400 islands, consists of islets of coral formation. The larger islands, including Sulu (q.v.), Tawitawi (area, 232 sq.m.), Pangutarang (area, 42 sq.m.), Siasi (area, 30 sq.m.), and Tapul (13 sq.m.), are of volcanic origin. With the exception of Siasi, all of the larger islands give their names to neighboring groups of islets. Tawitawi and Sulu islands are traversed by mountain

chains with elevations ranging between 1000 and 3000 ft. The vegetation, which is closely related to that of Mindanao, is luxuriant, and there are large forests, notably valuable stands of teak and bamboo. The principal crops, raised mainly for domestic consumption, are rice, corn, cacao, coffee, sesame, cotton, and hemp. Livestock raising and pearl and pearl-shell fishing are important industries. The manufactures include cordage and cutlery. Moros (see **MORO**) comprise the majority of the population, and Mohammedanism is the dominant religion. The capital of the province is Jolo (pop., about 45,000), a seaport on the island of Sulu. Area of archipelago, 1082 sq.m.; pop., about 173,000.

**SULU SEA**, an arm of the Pacific Ocean, lying between the Philippine Islands on the n., e., and s.e., Borneo on the s.w., and Palawan Island on the w. and s.w. A number of small islands are situated in the Sulu Sea. Among these islands are the Pangutarang group of the Sulu Archipelago, the Cuyo Islands, Cagayan Island, and Bancoran Island.

**SULZBACH**, a commune in Saarland, situated about 6 miles s.w. of Saarbrücken. It consists of several villages, and is an industrial center, noted particularly for coal mining, metallurgical industries, and the manufacture of glass. Pop., about 22,000.

**SUMAC** or **SUMACH**, common name applied to any of the many deciduous or evergreen shrubs and trees belonging to the genus *Rhus* of the Cashew family, Anacardiaceae. The genus contains over 150 species native to temperate and subtropical regions throughout the Eastern and Western hemispheres. The foliage and bark of most sumacs is rich in tannin, used extensively for tanning leathers. Some species are poisonous to the touch and are routinely destroyed; others are cultivated widely in the United States for decorative and ornamental purposes. The greenish-white to yellow flowers, arranged along the stem in axillary or terminal panicles, have a five-parted calyx, five petals, five stamens, and a solitary pistil. The fruit is a dry, one-seeded, usually showy, indehiscent drupe.

The most poisonous variety of sumac is the poison sumac, or poison elder, *R. vernix*, a tree or shrub found growing wild in swamps throughout the eastern part of North America and attaining a length of 20 feet. It bears greenish-white flowers and drooping clusters of greyish-white fruits. The leaves, which

consist of seven to thirteen leaflets, are noted for their brilliant scarlet color during the autumn months. Another poisonous variety, the familiar poison ivy is a semi-erect, vine-like shrub, *R. toxicodendron*, found along roadsides, gardens and waste places throughout the eastern portions of North America. By means of aerial rootlets it is often able to attain considerable heights in wooded areas. It bears loose clusters of inconspicuous greenish flowers and small, round, greyish fruits, the latter remaining on the plant throughout the winter. The leaves consist of three oval, pointed leaflets which vary in length from 1 to 6 inches. They are glossy above and slightly hairy beneath, and assume deep scarlet and orange hues during autumn. The poison ivy inhabiting western United States, *R. diversiloba*, is similar to *R. toxicodendron*, but is more shrubby in growth. Many persons are sensitive to the poisonous nonvolatile oil, called toxicodendrol, which is contained in the leaves, bark, root, and fruit of poison-ivy plants. After contact with these plants, such persons suffer extreme burning, itching, and swelling of the skin; see ILL. POISONING.

Varnish tree or lacquer tree, *R. verniciflua*, native to China, Japan, and the Himalayas and cultivated in New England, attains a height of 60 feet. It bears white, loosely clustered flowers and smooth, straw-yellow fruit. The leaves consist of eleven to fifteen leaflets, each approximately 6 inches long. The sap of the lacquer tree contains a phenolic liquid called *urushiol*,  $C_{15}H_{14}O_2$ , from which *urushi* or Japanese lacquer, used to impart a high luster to woodenware, is manufactured. Urushiol is poisonous to the touch in the liquid state, but is nontoxic when dry. Wax tree, *R. succedanea*, is a poisonous shrub or small tree native to Asia and attaining a height of 30 feet. It produces a waxlike substance used chiefly in the manufacturing of candles. The leaves, which consist of eleven to fifteen rounded, short-stalked leaflets, are about 6 inches in length. The yellowish-green flowers bear whitish, compressed fruits.

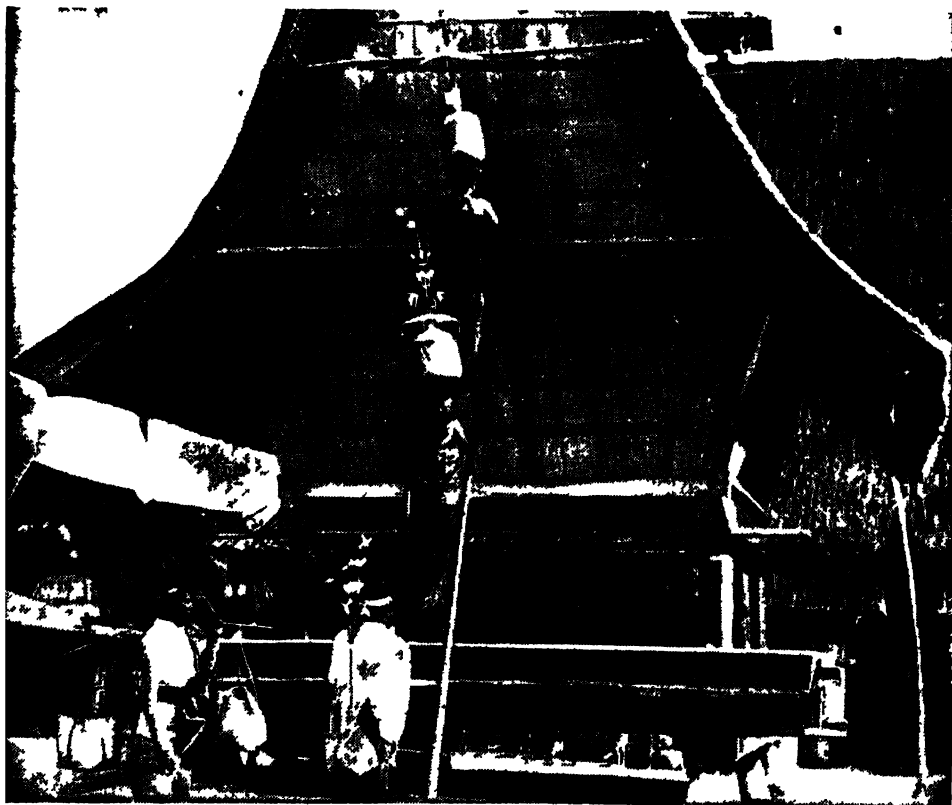
Nonpoisonous species of sumac include the staghorn sumac, *R. typhina*, a tall North American shrub or tree which attains a height of 30 feet and is grown extensively in the U.S. for ornamental purposes. Its greenish, clustered flowers produce red fruits which persist throughout winter. Smooth sumac, *R. glabra*, is a small shrub, no higher than 15 feet, and common in the s.w. portions of the United States. It is prized as an ornament

because of its large, dense, green flowers and finely cut, brilliantly colored leaves. The showiest of the sumacs, *R. javanica*, is a shrub or flat-topped tree native to Asia and cultivated in New England. It grows as high as 25 feet and blooms late in the year, usually in August and September. Its characteristic large, creamy-white flowers are arranged in long panicles, and bear dense, red fruits which are thickly covered with fuzz. *R. coriaria*, a shrub native to the Mediterranean region of Europe and w. Asia, is a principal source of tannin. It grows to a height of 20 feet, and bears loose, terminal panicles of green flowers.

Sumac may be easily cultivated in any dry soil by seed or root cuttings. Some poisonous species spread readily by suckers, and are difficult to eradicate. Common enemies of cultivated sumac include: the gall mites, which injure flower spikes; various aphids, which feed on the undersides of the leaves and form saclike galls on the leaflets; and the jumping plant louse, which destroys leaves and flowers.

**SUMAROKOV**, ALEXANDER PLOTVOICH (1718-77), Russian writer, born in Finland. He entered the military service and reached a high rank. When the first permanent theater was established at St. Petersburg in 1756 he was made director, and also wrote plays for production at the theatre. Petty of character, quarrelsome, and overambitious, he left the capital, incensed at the insufficient recognition he had received, and began to stage his works at Moscow. After a time he got into disputes with the management of the theatre there, and in despair took to drink, dying in obscurity. A rough clumsy and ineffective, Sumarokov's tragedies played an important part in the development of the Russian drama, into which he was the first to introduce the French pseudoclassical theory. His comedies and satires have a great deal of genuine humor and wit, and influenced considerably Sumarokov's followers. Sumarokov attempted every kind of literary production except the novel. His best-known drama, *The False Demetrius*, has been rendered into English as *Demetrius the Impostor* (London 1806).

**SUMATRA**, the westernmost of the Sunda Islands and, after Borneo, the largest island of the Great Sunda Islands of the Malay Archipelago, formerly part of the Netherlands Indies (q.v.) and, since 1945, within the Republic of Indonesia. The island extends in a s.e. to n.w. direction; it is separated by the



Republic of the United States of Indonesia

IN THE ISLAND OF SUMATRA *Top* View of native houses in Harau ravine, Bukittinggi, Sumatra  
*West Coast Bottom* Natives climbing a ladder to enter their house



Republic of the United States of Indonesia

ON THE ISLAND OF SUMATRA *Top* A market place in Minangkabau Benkulen *Bottom, left* A native wearing the headdress of the unmarried *Bottom, right* A young woman of Minangkabau

Strait of Malacca (35-185 m. wide) from the Malay peninsula on the n.e. and by Sunda Strait (16 m. wide) from Java on the s.e. Sumatra consists of the three provinces of North Sumatra, Central Sumatra, and South Sumatra. The largest city on the island is Palembang. Area, 180,000 sq.m.; pop. (1940 est.) 11,490,000.

The island has a maximum length of 1050 m. and a width of from 90 to 240 m. A great mountain chain, known as the Barisan Mts. and including several parallel ranges, traverses Sumatra, following the w. coast. Many of its principal summits are extinct, dormant, or active volcanoes. The highest peak on Sumatra is Korintji (12,14 ft.). On the e. side of the mountain axis is a broad, gently sloping plain where all the main rivers flow, including the Musi, Jambi, Indragiri, and Kampar, of much importance for interior navigation. The largest of the many Sumatran lakes is the salt-water Lake Toba, about 50 m. long. The equator passes nearly through the center of the island, and the mean annual temperature ranges from 77° to 81°F. Annual rainfall varies from about 90 to 185 in. The soil is extremely fertile, and most of the island is densely forested, its trees including bamboo, camphor, teak, eucalyptus, and pine. The fauna includes the elephant, rhinoceros, tiger, tapir, panther, and other animals common to equatorial regions. Mineral deposits are large and include coal, tin, petroleum, gold, silver, and iron. Agriculture is the predominant industrial activity, and is pursued on small farms by the Sumatran natives, or on large, European-owned plantations. The principal native food crops are rice, by far the largest, and corn. Estate cultivation concerns itself primarily with rubber, tobacco, tea, palm oil, and agave fiber. Pepper, coffee, coconuts, cotton, and spices are also grown, principally for export.

The indigenous Sumatrans belong, linguistically and culturally, to the Malayan peoples, and are sometimes grouped as Indonesians. Among the most important tribes are the Achinese, in the extreme n.w., the Battaks, on the n.w. coast and n. interior, and the Gayos, in the n. central plateau. Mohammedanism is the prevailing religion in the coast districts and, to a great extent, in the interior. The population includes large groups of Indians, Chinese, and Arabs, and some Europeans, who live principally in the coastal regions.

Marco Polo, the Italian explorer, visited the island in 1292 and in 1293. Portuguese

traders established commercial stations there. In the 17th century the Dutch obtained a foothold on Sumatra and gradually extended their dominion. Toward the end of the same century the British established themselves at Benkulen. Anglo-Dutch rivalry was bitter until 1824, when Benkulen was ceded by the British to the Netherlands in return for Malacca. Throughout the 19th century the Dutch continued to extend their authority over native rulers, the last great struggle (1873-1903) being with the Achinese. Almost all Sumatra was occupied by Japanese troops during World War II, from Feb. 15, 1942, the first invasion, until the conclusion of the war in Aug., 1945. Sumatra became a principal component of the native struggle for independence following the war. See REPUBLIC OF INDONESIA; UNITED STATES OF INDONESIA.

**SUMBAWA** (Du. *Soembawa*), one of the Lesser Sunda Islands, forming part of the province of the Lesser Sunda Islands, Republic of Indonesia, and situated due e. of Lombok Island. It is traversed, in an e. and w. direction, by four mountain ranges, the northernmost of which is volcanic. A violent eruption in 1815 of Tambora (8940 ft.), the principal volcano, caused extensive loss of life. The soil of Sumbawa is fertile, and farming and livestock raising are important industries. Among the chief crops are rice, tropical fruits, tobacco, and cotton. The pearl fisheries are important, and valuable stands of timber, including teak and sapanwood, are situated on the island. Raba, a seaport on the n.e. coast, is the principal town. Area, 5129 sq.m.; pop., about 315,000.

**SUMDUM, or HOLKHAM, BAY**, one of the most remarkable of the glacial fiords of southeast Alaska, situated about lat. 57° 30' N., long. 133° W. It debouches into Stephens Passage.

**SUMER**, in ancient history, the name applied to a region approximating the s. half of Babylonia (q.v.), between the Tigris and Euphrates rivers. It was the site of the first great civilization of w. Asia, flourishing from about 4500 B.C. until its final decline and conquest by Babylonia about 1900 B.C. Sumer was a closely-knit group of city-states, including Adab, Eridu, Lagash, Larsa, Uruk, and Ur, rather than a political entity. Each city was ruled by kings or royal dynasties which from time to time brought the entire region under their sway. The Sumerians themselves were a people of obscure racial



centuries the invasion of Semites into N  
Babylon which resulted in the establishment  
of Accad (q v ), the n portion of Babylonia

The Sumerians developed a culture which was later adopted by the Semites of Accad and engendered the greater Babylonian civilization. They were the first to create a written code or civil law and their cuneiform (q v) writing was taken over by Babylonians which also used Sumerian as its religious language (see SUMERIAN LANGUAGE). Though primarily an agricultural people the Sumerians developed a flourishing commerce and a banking system. Conflict between city states resulted in their creation of notable military devices and organizations. See MESOPOTAMIA.

**SUMERIAN LANGUAGE**, the language spoken by the Sumerians (See BABYLONIA). The first successful decipherers of the cuneiform characters were Hinks, Rawlinson, and Oppert. The attempts to discover the affinities of this language have not yet been useful, but it is probably the oldest known language in the world; it has in every word an *a* vowel and *l* as the first letter. The Greek transcriptions show. From the Sumerian vocabulary it is evident that the people who spoke this language had reached a comparatively high civilization. Their system was in agriculture, beekeeping, astronomy and mathematics, and with much plausibility ascribed to the race who spoke the *h* *him* *Shumeri* or Sumerian language. See CUNEIFORM.

**SUMIDA-GAWA**, river on the left of Hondo, flowing into the northwest of Tokyo on the border of the province of Musashi and Kanagawa, entering the Bay of Tokyo at a distance of some 30 miles. It is famous for the scene of a festival called river-pyromancy.

**SUMMARY PROCEEDINGS**, in law a trial in England and the United States trial conducted by a judge without a jury and in a speedy and peremptory manner. Such proceedings must be specifically authorized by legislative enactment as for example by the statutes in some States of the U.S. permitting the trial of petty offenses such as reckless driving to be conducted by a judge. In some States a statutory proceeding to evict or dispossess a tenant is also designated a summary proceeding.

**SUMMER CATARRH.** See HA, FLYLK

**SUMMERFIELD, ARTHUR L.** (115WORTH) (1899- ), American business executive and political leader, born in Pinconning Mich and educated there in the public schools. In 1919 he founded a real estate agency in part-



Student's  $t$ -test was used to compare the mean values of the two groups.

nership with his father. He established an oil distribution business in Ann Arbor in 1911 and after 1919 owned and operated an automobile sales agency in that city. During the 1940 Presidential campaign his exceptional organizational ability contributed substantially to the Republican victory in Michigan. Summerfield was elected finance director of the State Central Committee of the Republican Party in 1943 and a member of the Republican National Committee in 1944. At the Republican National Convention of 1952 he supported Gen. Dwight D. Eisenhower's

candidacy for the Presidential nomination. Soon after the convention he was made chairman of the Republican National Committee. He became postmaster general in President Eisenhower's cabinet.

**SUMMER REDBIRD**, or **TANAGER**. See **TANAGER**.

**SUMMERS, THOMAS OSMUND** (1812-82), American Southern Methodist clergyman, editor, and theologian, born in Corfe Castle, Isle of Purbeck, Dorsetshire. He came to America in 1830, and joined the Baltimore Conference (1835). He was missionary to the Republic of Texas (1840); was transferred to the Alabama Conference (1843); was secretary of the Louisville convention at which the Methodist Episcopal Church South was organized; and subsequently was secretary of every General Conference of his church until his death. As general book editor from 1845 until his death, he edited most of the publications of the denomination. He founded the *Sunday School Visitor* and edited it for four years; the *Quarterly Review* he edited for nine years. Summers was professor of systematic theology at Vanderbilt University and dean of the theological faculty (1872-82). He wrote numerous works, including a commentary in six volumes on the Gospels, Acts, and Romans (1868-74) and *Systematic Theology* (2 vols. 1888).

**SUMMERSIDE**, county seat and port of entry of Prince County, Prince Edward Island, Canada, situated on Bedeque Bay, about 35 miles n.w. of Charlottetown. The town is linked to other parts of the island by railway and to the mainland by railway and vehicular ferries. Additional transportation facilities include a deep natural harbor, a seaplane base, and an airport. Silver-fox breeding is carried on extensively in the surrounding region, and Summerside is the leading market in Canada in the silver-fox fur trade. It is also an industrial center, with plants engaged in the manufacture of farm machinery, lumber, flour, and livestock and fox feeds. Pop., about 5000.

**SUMMERVILLE**, a town of Dorchester Co., S.C., situated 25 m. by rail n.w. of Charleston. It is the trading center of an agricultural area, and a winter resort. The town lies in a healthful region of the coastal plain and is surrounded by pine forests. It is noted for the camellias, azaleas, roses, wistaria, jessamine, and dogwood grown there and in the vicinity. The Municipal Azalea Garden, with 28,000 plants, and the Pine Hurst Gardens, containing numerous

rare floral specimens, are two of the renowned gardens in the town. Recreational facilities include a golf course, excellent hunting and fishing areas, bridle paths, and two annual horse-racing meets. In the vicinity of the town is Fort Dorchester, built about 1750. Pop. (1950) 3312.

**SUMMIT**, a village of Cook Co., Ill., situated on the w. limits of Chicago, of which it is a residential suburb, and on the Illinois-Michigan Canal. Pop. (1950) 8957.

• **SUMMIT**, a city of Union Co., N.J., situated 12 miles w. of Newark and 21 miles w. of New York City. It is served by two railroads. The principal industries in the city and vicinity are general farming, the cultivation of fruits and roses, and the manufacture of silk goods and chemicals. The city occupies a high crest which served as a sentry lookout during the Revolutionary War; a monument marks the site of the lookout post. Summit was settled in 1795, incorporated as a township in 1869, and chartered as a city in 1899. Pop. (1950) 17,929.

**SUMMIT HILL**, a borough of Carbon Co., Pa., situated about 9 miles s.w. of Mauch Chunk. It is a coal-mining center, and is famous for its burning coal mine, which has been on fire since February, 1859, consuming millions of tons of coal. Other important industries in the borough are the quarrying of granite and marble and the manufacture of sportswear. The Mauch Chunk Switch Back Railroad one of the earliest railroads in the U.S., was built for the transportation of coal between Summit Hill and Mauch Chunk in 1827; it was in operation for over a hundred years. Coal was discovered in the vicinity in 1791 and the coal company founded at that time is still in production. Pop. (1950) 4924.

**SUMMONS**, in the law of civil procedure in the United States, a writ or process (q.v.) by which a defendant is notified to appear in court and answer the cause of action alleged in the plaintiff's complaint. Unless there is a specific statutory provision permitting a summons to be signed by the plaintiff's attorney, it usually must be signed by the clerk of the court in which the action is brought. The following form is an example of a summons.

Supreme Court of the State of New York

John Doe

Plaintiff

—against—

Richard Roe

Defendant

To the above named defendant:

You are hereby summoned to answer the complaint in this action, and to serve a copy of your answer or, if the complaint is not served with this summons, to serve a notice of appearance on the plaintiff's attorney within twenty days after the service of this summons, exclusive of the day of service; and in case of your failure to appear, or answer, judgment will be taken against you by default for the relief demanded in the complaint.

Dated: November 1, 1950

A and B

Attorneys for Plaintiff

Requisites of proper service of a summons are regulated by statute in the several States. As a general rule the summons must be handed personally to the defendant. In an action instituted against a nonresident of a State, most States provide that service may be made by publication of the summons as an advertisement in a newspaper, in the event that property of the defendant can be located and attached in such State. If the defendant is a resident of the State and leaves the State for the purpose of evading service or conceals himself for the same purpose, the statutes of most States provide that service can be made upon him by an order for substituted service. This order usually provides that proper service can be effected upon such defendant by mailing a copy of the summons to his last known address and leaving the same with a person of suitable age and discretion at his residence, if such person can be found there, and if not, by attaching the same to the door of such residence.

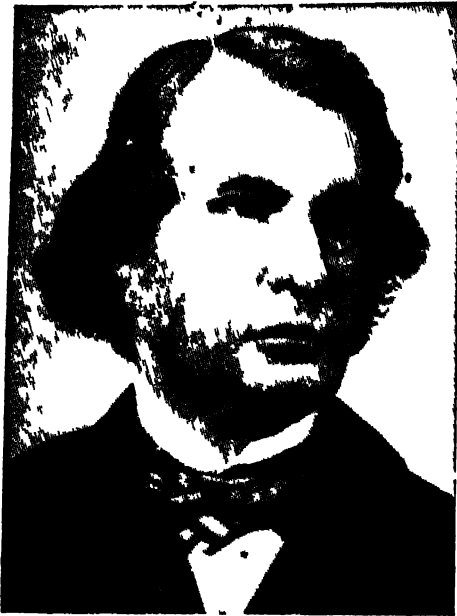
If several defendants are named in the same action, each one must be served individually; if, however, the action is against a partnership, only one of the parties need be served to obtain a judgment against the partnership, as such. Service on a corporation is made by serving an officer, director or managing agent of the corporation; the proper method of service on foreign corporations, that is, corporations chartered in States other than the one in which the action is brought, is dependent upon the statutory requirement in the particular State in which the action is instituted. Service is generally invalid if made on a Sunday; unless specifically prohibited by statute, service on other holidays is valid. Immunity from service of a summons is given persons who are called

to courts of another State to testify as witnesses.

The term "summons" is also used to denote the process issued by a magistrate, requiring a person charged with the commission of a misdemeanor to appear before the issuing magistrate; the issuance of such summons indicates that the magistrate is satisfied as to the existence of a prima facie case against such defendant. Summonses of this type are served upon the defendant in a manner identical with the service of ordinary summonses.

In the old common-law procedure in England, the first step in an action was the issuance of a writ (q.v.) known as the original writ, on the plaintiff's application; the writ commanded the sheriff to summon the defendant to give to the plaintiff the relief demanded by him or appear before the next term of court and show cause why such relief should not be granted. The writ was served personally on the defendant by the sheriff. Subsequently, the courts came to dispense with the original writ as a means of acquiring jurisdiction, and the action was begun by the issuance by the courts of their judicial process, designated the writ of summons, or summons, instead of the original writ. In modern legal procedure in England under the Judicature Acts (q.v.) every civil action, both at law and equity, is commenced with the issuance of a writ of summons by the court. See PROCEDURE.

**SUMNER**, CHARLES (1811-74), American statesman, born in Boston. In early life he maintained unusual literary activity, writing chiefly upon legal topics. In 1840 he began to take an active interest in the antislavery movement, and in 1845 he delivered an oration at Boston on "The True Grandeur of Nations". In 1851, through a combination of Free Soilers and Democrats, he was elected to the United States Senate, of which body he was a member until his death. Here he waged an uncompromising war on slavery. His first important speech (August, 1852) was entitled "Freedom National; Slavery Sectional". This was followed in 1856 by another on "The Crime against Kansas", in which he reflected severely upon Senator Butler of South Carolina. This arraignment led to an assault in the Senate chamber upon Sumner by Preston Brooks, a Southern representative and a relative of Butler, Sumner being so injured that he was incapacitated for nearly four years. This attack led to the disease which ended his life. In 1860 he delivered a



*Charles Sumner*

speech on "The Barbarism of Slavery." In 1861 he became chairman of the Senate Committee on Foreign Relations. For ten years of a critical period Sumner held this chairmanship. At the close of the Civil War he secured the enactment of a civil rights law to secure equality of treatment to Negroes in public places subsequently declared unconstitutional by the United States Supreme Court.

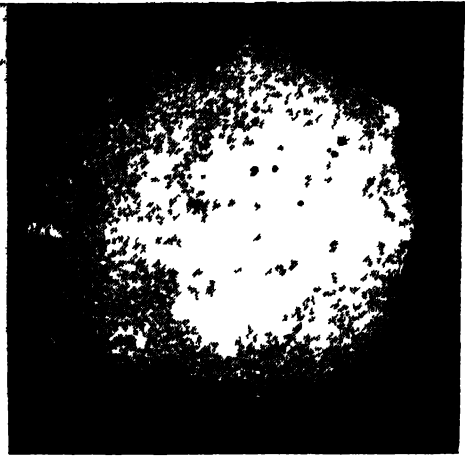
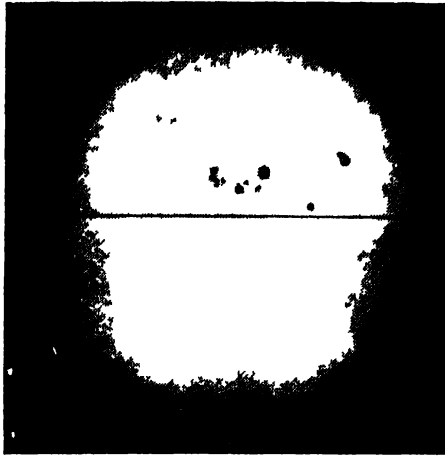
**SUMNER, INCREASE** (1746-99) American jurist born in Roxbury, Mass. He was a member of the State Constitutional Convention of 1779. In 1782 he was elected to Congress but at the same time was offered an associate justiceship of the Supreme Court which he held until 1797. In 1789 he was a member of the convention which adopted the Constitution of the United States. In 1797 he was elected governor of Massachusetts, and held that office during the remainder of his life.

**SUMNER, JAMES BARTLETT** (1887-1955) American biochemist born in Canton, Mass., and educated at Harvard University. In 1914 he joined the faculty of Cornell University as assistant professor of biochemistry, he became full professor and director of the Cornell Enzyme Research Laboratory in 1929. A pioneer in enzyme (qv) research, Sumner accomplished the first isolation of an enzyme

obtaining (1926) urease in pure form. He shared the 1946 Nobel prize in chemistry with the American biochemists Wendell M. Stanley and John H. Northrop.

**SUMPTUARY LAWS**, laws enacted in former times for the purpose of preventing extravagant expenditures by individuals. In ancient times the Greeks and Romans passed laws to discourage spending. Greece endeavored by such legislation to establish simple habits of life as by forbidding women to wear expensive clothes. In early Roman history legislation was enacted to limit the expenditures on women's apparel and jewelry on bouquets and on funerals. In England in the period from the 13th to the 15th centuries sumptuary laws were enacted to regulate private expenditures on food and clothing. In the reign of Edward III, for example, statutes were enacted regulating according to a man's social rank the number of courses permitted to be served to him at a meal and the type of food served in each course and the clothing he might wear. Most of these restrictions were repealed during the reign of James I and the remainder were abolished by Queen Victoria in 1857. In France sumptuary laws regulating expenditures on clothing were enacted by Charlemagne and by other rulers down to the time of Louis XV. Sumptuary laws governing expenditures on food and clothing were enacted in many of the early American colonies. In the United States the term sumptuary legislation is sometimes applied to laws for the prevention or punishment of intemperance (see PROHIBITION).

**SUMTER**, county seat of Sumter Co., S.C., situated 45 miles east of Columbia. It is served by two railroads. Among the industrial establishments in the city are lumber mills, woodworking shops, foundry and machine shops, printing and publishing plants, textile mills, food canneries, bottling works, chemical plants, a pikeon processing plant from which 100,000 squabs are shipped annually, and factories manufacturing furniture and stone, clay and cement products. Sumter is the site of Morris College (Baptist) for Negroes established in 1905. The city contains many beautiful gardens including Swin Lake Gardens, noted for Japanese iris, Blind Town Garden, with evergreens and roses, and Memorial Park. In the vicinity of the city is Poinsett State Park, covering 1000 acres, named in honor of the American diplomat Joel R. Poinsett, for whom the poinsettia is named. Sumter was founded in



Yerke Observatory

THE SUN Left Direct photograph Right Calcium spectrum pectroheliogram

1800 and named for Gen. Thomas Sumter, a hero of the American Revolution. It was chartered as a city in 1887 and was one of the first in the South to adopt the commission manager form of government in 1917. Pop. (1950) 20,155.

**SUMTER, THOMAS** (1744-1820) American soldier, born in Hanover County, Va. He served during the French and Indian War. He is best known for his service during the War of Independence, but saw little active service until after the fall of Charleston in May 1780, when he earned the surnames "Gamecock." He defeated a cavalry with forces between Charleston and Camden and later defeated Major James Wemyss at Fishdam, and repulsed Moulton's attack at Blackstock in 1780. He was a member of the State convention which ratified the Federal Constitution for South Carolina in 1788. In 1793, and again in 1797-1801, he was a member of the national House of Representatives and of the United States Senate from 1801 to 1810.

#### **SUMTER, FORT.** See FORT SUMTER

**SUMY**, capital of the Region of the same name, Ukraine, USSR, situated near the Polish border. The principal products are sugar, agricultural machinery, clothing and leather goods. Sumy was founded in 1655. Pop. about 61,000.

**SUN**, the self-luminous celestial body which, by the gravitational effects of its mass, holds together the planetary system which includes the earth. By the radiation of its light and heat the sun furnishes directly or indirectly, almost all of the energy

supporting life on the earth, because all food and fuels are derived ultimately from plants using the energy of sunlight. At the surface of the sun energy is radiated at the rate of more than 100 horsepower per square inch; this energy is radiated in all directions, and because of the distance of the earth from the sun (93,000,000 miles mean radius) the amount reaching the earth is only about five ten-billionths of the total or approximately 1.5 horsepower per square yard.

The sun is a radiant sphere, brighter in the center than at the limb or edge, with an apparent angular diameter of 31' and a parallax (q.v.) of 8.80". It has a mean diameter of 864,000 miles, one hundred and ten times that of the earth; its mass is 332,946 times that of the earth and its volume 1,000,000 times. The sun is only one-fourth as dense as the earth; its specific gravity being 1.41. Its surface gravity is 27 times that of the earth. The rotation of the sun about its axis, unlike the uniform rotation of the earth and other solid bodies, is more rapid at the solar equator than at the poles; a point on the equator makes the complete revolution of the sun in 24.47 terrestrial days, while a point at solar latitude 45° takes 7 days. The rotation produces no measurable bulge at the equator or indentations at the poles; hence the sun is essentially a perfect sphere. The entire solar system, consisting of the sun, the planets, asteroids, comets, and meteors (q.v.), is moving through space at a speed of almost 12 miles a second toward a point near the star Vega (α Lyræ).

The bulk of the sun is made of the same chemical elements as are found on earth, except that the atoms are in a state of high excitation (see ATOM AND ATOMIC THEORY) due to the enormous temperatures and pressures of the interior of the sun. Although such conditions are not reproducible on earth and direct observation is impossible, theoretical calculations indicate that prevailing temperatures and pressures near the center of the sun are approximately 40,000,000°C. (72,000,000°F.) and 5,000,000 tons per square inch. Under such conditions matter exists chiefly as atomic nuclei stripped of practically all orbital electrons, and packed so closely that, although matter exists in a gaseous or quasi-gaseous state, each cubic inch would, at the surface, of the earth, weigh several tons. In the deep interior of the sun is generated energy which is radiated outward as extremely high frequency radiations; the energy is absorbed and reradiated by successive layers of solar material, until it radiates from the surface of the sun as heat and light. The source of the energy is believed by astrophysicists to lie in two phenomena. the heating of a gas by contraction in a gravitational field; and a closed cycle of atomic nuclear reactions through which matter is transformed into energy. Energy is radiated from the total surface of the sun at a rate of  $3.79 \times 10^{38}$  ergs per second; this radiation results in a loss, each second, of 4,000,000 tons of matter, an infinitesimal amount compared with the total mass of the sun of  $2 \times 10^{37}$  tons.

The visible surface of the sun is called the photosphere, a layer of incandescent gas several hundred to several thousand miles in depth, and having a temperature of about 5800°C. (10,500°F.). Surrounding the photosphere is a shallow reversing layer, a layer of gas so much cooler and rarer than the photosphere that it absorbs the spectrum lines of its component elements from the light of the photosphere (see SPECTROSCOPY), and is the layer which produces the Fraunhofer lines in the spectrum of the sun. Blanketing the reversing layer is the chromosphere, an extremely tenuous layer of incandescent hydrogen, helium, and calcium vapor, 8000 to 9000 miles in thickness; it is visible as a rosy ring surrounding the sun just before and just after the total phase of a solar eclipse (q.v.). The outer edge of the chromosphere is characterized by prominences, extrusions of glowing gases into space in torchlike or cloudlike protuberances. These

prominences are believed to be masses of chromosphere gas exploded into space at speeds of more than 100 miles per second, and often rising to heights of thousands of miles before falling back. The chromosphere and its prominences can be photographed even in full sunlight by means of the spectroheliograph (q.v.), which utilizes a single bright line in the spectrum of calcium or of hydrogen, thereby eliminating the light from the photosphere which would ordinarily mask the detailed structure of the chromosphere. Beyond the chromosphere is the outermost envelope of the sun, the corona, which is visible only during a total eclipse. It consists of extremely rarefied gas, and shines chiefly by reflecting ordinary sunlight. Several lines in its spectrum originally thought to be produced by nonterrestrial elements (for example, coronium; q.v.) have been recently identified as ordinary elements, such as oxygen and iron, in a high degree of ionization.

Sunspots are the only phenomena visible on the solar surface for any appreciable length of time, lasting, sometimes, as long as several months. They vary in size from minute pores, scarcely visible with a good telescope, to enormous areas 100,000 miles across, and visible to the naked eye. Sunspots are the result of enormous vortices, or cyclones, in the photosphere; the expanding gases in the center of the vortex, being cooler than the photosphere, appear black by comparison. The black center, or umbra, is surrounded by a lighter, radially striated border, the penumbra. Sunspots are polarized magnetically, and generally appear in pairs of opposite polarity. Often when only one spot is visible, magnetic investigation has revealed its companion to be invisible below the surface of the photosphere. The frequency of appearance of sunspots varies in a regular cycle of approximately eleven earth years. After the minimum period of the cycle a few spots appear in high solar latitudes, about 35° N. and S. of the solar equator. As the cycle progresses, the spots become more numerous, and the positions at which they appear move toward the solar equator until at maximum, about half through the cycle, the sunspots are concentrated in two zones, 15° N. and S. of the equator. After the period of maximum, the number of sunspots declines, but the sunspots belt continues to move toward the solar equator until, as the cycle approaches its minimum period, the spots die out in zones about 5° N. and S. lat.

Associated with the sunspots, and following the same cycle of frequency, are exceptionally bright areas in the photosphere, called *faculae*. Like the prominences described above, faculae are most numerous in the neighborhood of sunspots, but they frequently appear scattered all over the sun's disk, even in high solar latitudes, where sunspots are never observed. Also associated with the sunspot cycle are terrestrial phenomena which include magnetic storms and displays of the aurora. See ASTRONOMY.

**SUN ANIMALCULE**, common name applied to any of the microscopic, fresh-water protozoans constituting the order Heliozoa of the class Sarcodina. The animals are so called because, when viewed under the microscope, they look like a sun surrounded by rays of light. Structurally, the sun animalcules consist of a central mass of protoplasm from which numerous, stiff pseudopodia radiate. Smaller animals coming in contact with the animalcule stick to the rays and are engulfed by fleshy feeding pseudopodia. Sun animalcules are usually naked but are sometimes enclosed in a siliceous coat. Occasionally, they congregate on submerged plant stalks, forming colonies; usually, they are free-swimming. *Actinophrys sol* is the common sun animalcule of stagnant ponds in the United States.

**SUNBIRD**, common name applied to any of the tiny, oscine birds constituting the family Nectarinidae, and inhabiting tropical regions in Africa, Asia, the East Indies, and Australia. The birds resemble hummingbirds in form and habits, differing chiefly in having thin, curved bill. Male sunbirds are tinted with brilliant, intense colors, and sing sweetly. Sunbirds feed on small insects and on the nectar of flowers. They nest in hollows of trees and in bushes; some species construct a dome-shaped nest which hangs from the end of a limb of a tree. The Jericho sunbird, *Nectarinia* or *Cinnyris osea*, is 3 inches long.

**SUN BITTERN**. See GRUPELMES.

**SUNBURY**, county seat of Northumberland Co., Pa., on the Susquehanna River 53 miles N. of Harrisburg. It contains foundries, machine shops, and planing mills, and manufactures woolen and silk goods, carpets, and flour. It was the site of an Indian village and of a fort built during the French and Indian War in 1756. Pop. (1950) 15,570.

**SUNDA ISLES**, one of the chief island groups of the Malay Archipelago (q.v.), lying between the Java Sea and the Pacific Ocean and forming (except as noted below)

part of the Republic of Indonesia. In physical geography the Sunda Isles are divided into the Greater Sunda Islands, which include Celebes, Sumatra, Java, Borneo, and various smaller islands; and the Lesser Sunda Islands, extending generally eastward from Java and including Bali, Lombok, Sumba, Flores, and Timor. Part of Borneo and part of Timor are controlled respectively by Great Britain and Portugal. Area of Sunda Isles, 543,374 sq. m.; pop., about 55,000,000.

**SUN DANCE**, religious dance of certain tribes of North American Indians performed in veneration of the sun. It was a dance of the Sioux, Blackfeet, Dakota, Assiniboine, Ponca, Cheyenne, Arapaho, Crow, Plains Cree, and Sarcee. It was held usually for five to fourteen days in the beginning of July.

**SUNDBANS**, or SUNDBUNDS, waste land of the delta of the Ganges on the Indian Peninsula, between the mouths of the Hugli and Meghna. The total area is estimated at 6500 sq. m. The region is alluvial, is intersected by a network of streams, and contains a vast number of swamps and morasses.

**SUNDA STRAIT**, a channel between the islands of Sumatra and Java, linking the Indian Ocean and the Java Sea. The strait, which ranges between 16 and 100 m. in width, is extensively employed by ocean shipping. Several islands are situated in Sunda Strait, notably Krakatoa (q.v.).

**SUNDAY**, first day of the week, observed by Christians almost universally as a holy day in honor of the resurrection of Christ. The hallowing of Sunday appears incontestably as a definite law of the church in the beginning of the 4th century. The emperor Constantine confirmed the custom by a law of the state. Throughout the medieval period the authority of the church was so universally recognized that secular legislation in this regard was almost unnecessary. The Catholic Church then required, and still requires, abstinence from servile work on that day, and the assistance at Mass of all who are not lawfully hindered.

In the medieval period the courts were presided over or dominated by the clergy, and Sunday early became in the legal sense a *dies non*, on which legal proceedings could not be conducted. By common law, however, all other business might lawfully be transacted on Sunday.

The New England States were the first to regulate the observance of Sunday by a series of statutes. The Constitution of the United States prohibits the restriction of religious

liberty or the enforcement of religious observances, and therefore, in law, Sunday is regarded merely as, a civil day, which is a convenient one for the suspension of business, because of its observance as a holy day by a great majority of the people. These statutes are constitutional as a valid exercise of the police power. Works of necessity and great public convenience are usually excepted. See **BLUE LAWS**; **SUNDAY LAWS**.

**SUNDAY, WILLIAM ASHLEY**, popularly known as **BILLY SUNDAY** (1863-1935), American evangelist, born in Ames, Iowa. Between 1883 and 1890 he was a professional baseball player and from 189 to 1895 assistant secretary of the Y.M.C.A. in Chicago. He began his evangelistic work in 1896, and in 1903 was ordained a Presbyterian minister.

**SUNDAY ISLAND**. See **KERMADEC ISLANDS**.

**SUNDAY LAWS**, in the United States, statutes limiting the activities of persons on Sunday. The general purpose underlying the enactment of Sunday laws is to ensure the sanctity of Sunday as a day of rest and religious worship, through the curtailment of all industrial and commercial activity. Such laws may not, however, be specifically designed to enforce religious observance upon anyone, because the Federal Constitution explicitly forbids the passage of any laws abridging the freedom of religious worship. Most States have statutes on this subject, but such statutes are not uniform. In general, the purpose of the legislation is to prohibit ordinary business activity on Sunday; in some States, however, the prohibition applies only to specified businesses. Many States prohibit Sunday sports and theatrical activities. In some States contracts entered into on Sunday are held to be illegal and unenforceable. As a general rule legal process may not be issued or served on Sunday. See **BLUE LAWS**.

**SUNDAY SCHOOLS**, a term comprehending the various school systems and local schools maintained by the Christian and Jewish churches, wherein classes offering religious instruction to both children and adults are held on Sunday. The English religious leader Robert Raikes (1735-1811) is generally regarded as the founder of the modern Sunday-school movement. He established the first Sunday school at Gloucester in 1780, as a means of furnishing both secular and religious education to children whose employment in the factories prevented them from attending the secular schools. Under Raikes's sponsorship the movement spread so rapidly

that, by 1780 an estimated 250,000 children were attending Sunday schools. Later, as the number of children attending secular schools increased, the Sunday schools began to devote themselves chiefly, and ultimately exclusively, to religious instruction.

The Sunday-school movement spread to the Protestant churches of the United States early in the 19th century, and by 1824 had become sufficiently well established to make possible the organization of a central coordinating agency, the American Sunday School Union. The activity of Protestant missionaries in many parts of the world brought about the further spread of the movement, and in 1889 the first World's Sunday School Convention was held in London. Such meetings were held periodically in various countries thereafter, and eventually gave rise to the formation of the World's Sunday School Association, comprising numerous national and international Sunday-school organizations.

The Sunday schools of the Roman Catholic and Jewish churches differ from those of the Protestant churches in that the former are generally organized on a local rather than national and international basis. In the Roman Catholic Church of the United States, for example, students regularly attending Catholic parochial schools are not required to attend Sunday schools; the Catholic Sunday schools are designed to afford religious instruction only to individuals not receiving such instruction elsewhere. In addition, neither the Roman Catholic nor the Jewish church restricts its religious classes to Sunday; both hold classes at other times, depending largely on local conditions and the convenience of the church members. The Jewish Sunday schools are conducted almost exclusively by the Reformed and Conservative congregations; very few Orthodox congregations maintain such schools. The Jewish Sunday schools frequently offer instruction on Jewish history and traditions, as well as purely religious subjects.

In a recent year, the total enrollment in Sunday schools in all parts of the world was about 38,000,000; more than half of this enrollment was in the United States. The largest Sunday-school enrollment in the United States was that of the Methodist Episcopal Church, which had a Sunday-school membership of about 2,500,000.

**SUNDELIUS, MARIE** (1890- ), Swedish soprano, born in Karlstad. She came to the United States when she was ten years old,



made her debut as a singer in Boston, in 1910, and then became a member of the Metropolitan Opera Company. She was a member of the faculty of the New England Conservatory in Boston, Mass.

**SUNDERLAND**, seaport, county borough and market town of Durham, England, at the mouth of the Wear R., 12 m. from Newcastle upon Tyne. The township of Sunderland is on the south side of the river, and forms only a small portion of the county borough, which comprises also the townships of Bishopwearmouth, Monkwearmouth and Monkwearmouth Shore. Roker, a seashore resort is about 1 mile N. of the town. Coal is the principal export, averaging nearly 5 million tons annually. Sunderland is famous for its shipbuilding yards. There are also in the town extensive ironworks, forges, anchor and chain works, glass and bottle works, chemical works, roperies, paper mills, breweries, and lime kilns. Pop. of county borough (1911) 116,515.

**SUNDERLAND**, CHARLES SPENCER, 1st Earl of (1674-1744), English politician. He was the second son of the 1st Earl of Sunderland. He became Lord Spencer on the death of his elder brother in 1688. In 1700 he married Lady Anne Churchill, second daughter of the Duke of Marlborough. His political influence Sunderland attained several important posts and became a member of the famous Whig Junta which for a time controlled the whole government. In 1705 Sunderland brought about the establishment of the notorious South Sea Company. When the crash came he had to resign his office.

**SUNDERLAND**, JAMES EDWARDS (1811-1896), American Unitarian minister, born in Howarth, Yorkshire, England. He was pastor of churches in the United States, Canada, and England. As Billings lecturer of the American Unitarian Association he visited countries of the Far East in 1871. From 1885 to 1895 he edited the *Unitarian Monthly*. He wrote many books, including *India in 1894* (1894).

**SUNDERLAND**, ROBERT SPENCER, 1st Earl of (1640-1702), English politician. He was the only son of Henry Spencer, who was raised to the peerage in 1645. He was ambassador at Madrid, at Paris, and at Cologne, and in 1679 was made a secretary of state for the Northern Department and a member of the inner cabinet.

On the accession of James II he managed to obtain the entire confidence of James and in 1685 became lord president and principal

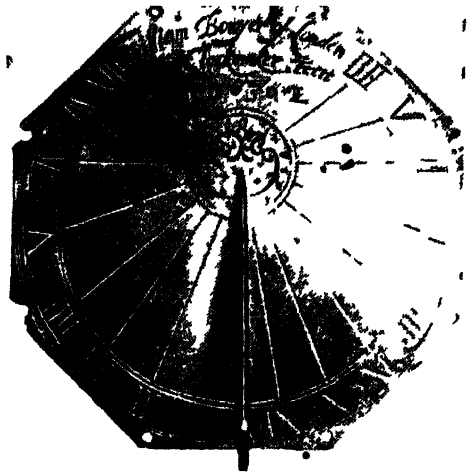


FIG. 1. A sundial. (From the *Illustration of the Sundial* by J. H. P. de la Roche.)

secretary of the Queen. Prince William of Orange arrived in England, Sunderland and his wife went to Antwerp, whence he wrote during his exile and protection on the ground that he had still been in his interest. In 1701 he was allowed to return to England, and in 1707 was made lord chamberlain.

**SUNDEW**, See CARNIVOROUS PLANTS.

**SUNDIAL**, an instrument for measuring time by means of the motion of the sun. It had with a clock and watch become common in all civilized countries. A first keeper of the clock and watch was appointed by the king and the king's council. The sundial was used for measuring time, and the king's council was appointed by the king and the king's council.

A sundial consists of two parts: the dial or face, usually the edge of a plate of metal made parallel to the earth's axis and pointing toward the pole, and the dial plane on which are marked the several hours of the day, then twelve quarters of the day. Sundials receive various names according to the positions they are constructed to occupy. When the sundial is level it is called a horizontal sundial; when perpendicular to that plane a vertical sundial. An equinoctial sundial is one whose plane is parallel to the equator. There are others: the south sundial, north sundial, east sundial, west sundial, polar sundial, and declining sundial.

**SUNDSVALL**, seaport of Västernorrland Province, Sweden, on a bay of the Gulf of Bothnia, 80 m. from Stockholm. It has iron works and saw mills and a large trade in iron and timber. Pop. (1951) 25,775.



**SUNFISH** (*Orthogoriscus*), name of a variety of fishes; the name is also given by sailors to jellyfish. In the United States it refers to a group of numerous and familiar fishes of streams and ponds, related to the bass, and forming several genera of the family Centrarchidae. A local name is pumpkin-seed. The blue sunfish is known also as copper-nosed bream and dollardee.

**SUNFLOWER**, common name applied to plants of the genus *Helianthus*, belonging to the Thistle family. The annual sunflower, *H. annuus*, common in flower gardens, is a native of tropical America, where it sometimes attains a height of 20 ft. The stem is

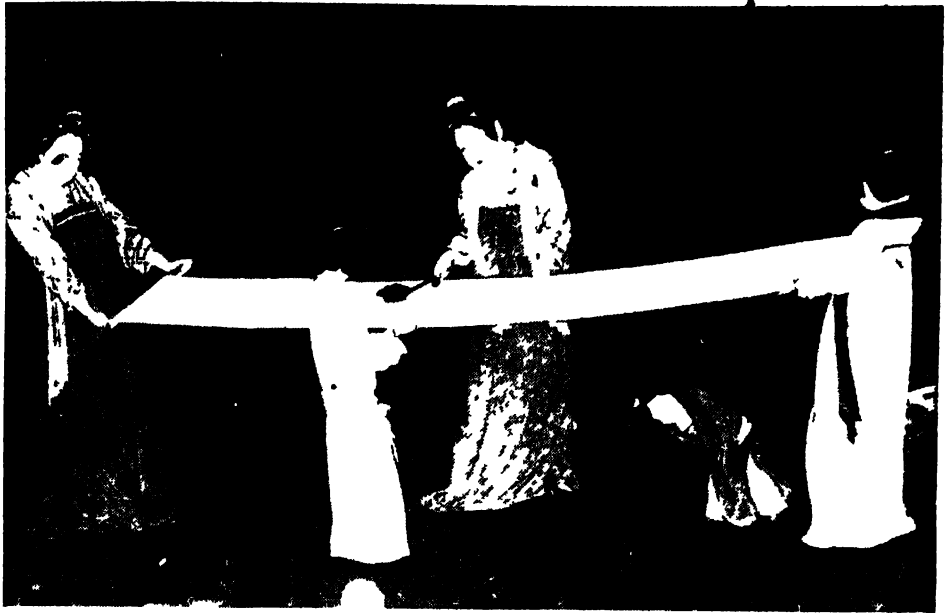


N.Y. State Museum

Left: Narrow-leaved sunflower (*Helianthus angustifolius*), a swamp wildflower of E. United States. Above: Annual sunflower.

thick and rough; the flower solitary, and from 1 ft. to 2 ft. in diameter.

**SUNG**, one of the seven great Chinese dynasties. It was founded in 960 by Chao Kw'ang-yin, a descendant of a family of officials of the T'ang dynasty (618-907), who had risen to high military command. With the empire rent with disorder, and the hordes of the Liao Tatars threatening on the north, the army concluded to raise their general, Chao, to the throne. Chao at once proceeded to repel the Liao and unify the empire by reducing the petty states. He introduced many reforms, and for sixteen years ruled with great wisdom and ability. The Liao, however, continued to encroach on Chinese territory, and in 1126, during the reign of the ninth emperor, established their authority over all of North China, styling their dynasty the *Kin* or "Golden". The Sung fled south to Hangchow (q.v.), which continued to be the capital of the diminished empire of the southern Sung. Nine emperors ruled here until 1279, when Kublai Khan and his Mongols overthrew both the Kin and the Sung, and established the Yuen dynasty in 1280. Notwithstanding the harassments and encroachments of invading armies, the Sung period was one of great prosperity and advance in civilization and culture.



Metropolitan Museum of Art

**ART OF THE SUNG DYNASTY.** *Top: Painting showing women ironing silk. Bottom, left: Porcelain jar dating from about 1108. Bottom, right: Wooden statue of the southern Sung empire*

**SUNGARI**, a river, of eastern Manchuria, approximately 1100 m. long, comprising an important tributary of the Amur. The Sungari rises in the mountains near the Korean boundary and flows n.w. through a region of heavy forests until it is joined by the Nonni R. in central Manchuria. At this point the Sungari turns sharply and flows in a n.e. direction through a level, fertile agricultural region, joining the Amur at Tungkiang.

**SUNGARIA**, or **DZUNGARIA**, a district in China between the central Tian-shan highlands of the Russo-Chinese frontier and the western Altai. It is a high mountain region, in which are the sources of the Black Irtysh and the Ili. The area (1,000,000 sq.m.) includes lakes, steppes, valleys, and fertile plateaus, besides barren mountains. The inhabitants are Sunnite Mohammedans and number about 600,000. It is chiefly of historical significance, deriving its name from the Sungarians, who attained their greatest power about the middle of the 17th century. About 1670 the ruler of Sungaria entered into conflict with the Chinese, who completely overran the country. The Chinese were driven out in 1710 and for a short time the rulers of Sungaria were masters of Tibet. In 1759 the Chinese, after long campaigns, destroyed the re-established Sungarian kingdom and annexed the country, peopling it largely with colonists from China.

**SUNN**. See **CROTALARIA**.

**SUNNE**, a town of Värmland County, Sweden, 84 miles e. of Kristianstad. Pop., about 10,000.

**SUNNITES**, orthodox Moslems who add the Sunna, or traditionary teaching of the Prophet, to the Koran. They are one of two sacerdotal and political factions, the Shiites and the Sunnites, in Islam. The latter sect took its name from a collection of books on traditional law, called the Sunna. The bulk of the population of Turkey are Sunnites. See **MOHAMMEDANISM**; **MOHAMMEDAN SECTS**.

**SUNNYVALE**, a city of Santa Clara Co., Calif., situated 41 miles s.e. of San Francisco. It is in the heart of the Santa Clara Valley, one of the richest vineyard and orchard regions in the U.S. Prunes, apricots, pears, and other deciduous fruits are grown in abundance in the surrounding area. Garden truck, sugar beets, livestock, dairy products, and poultry are other important products of the district, which is also noted for the breeding of saddle and racing horses. Industrial establishments in the city include extensive iron-works. Among the notable buildings in Sun-

nyvale is the Martin Murphy house, built by one of the original settlers from timber brought to the site in 1849 by ship around Cape Horn. The city is served by rail, and is the site of a U.S. Naval Air Station for dirigibles. Pop. (1950) 9829.

**SUNSET CRATER NATIONAL MONUMENT**, a national monument in Arizona, created in 1930 to preserve a notable volcanic crater. The monument covers an area of 3040 acres in the Coconino National Forest and contains Sunset Mountain, an extinct volcano which last erupted about the end of the 9th century. The volcano is of unusual interest because of the character of the sulfuric rock at its summit. The rock, through processes of decomposition and water staining, has become reddish in color, making the mountain appear as if bathed in the rays of the setting sun. Also of interest in the monument area are ice caves and large cinder and lava fields.

**SUNSHINE RECORDER**, an instrument for indicating the duration of sunshine. It is usually either a spherical lens whose focus moves with the sun, and leaves a scorched path on a curved strip of paper, or a dark chamber in which the rays, admitted through a minute hole, trace a line photographically on sensitized paper.

**SUNSPOTS**. See **SUN**.

**SUNSTONE**. See **FELDSPAR**.

**SUNSTROKE**. See **HEATSTROKE**.

**SUN WORSHIP**, religious devotion paid to the sun either as a deity or as the symbol of a deity. Sun worship was practiced by the Iroquois, Plains, and Chimmesyan Indians of North America, and reached a high state of development among the Indians of Mexico and Peru. The sun was also a Hindu deity, regarded as maleficent by the Dravidians of the south, and as benevolent by the Munda of central India. The Babylonians were sun worshipers, and in ancient Persia worship of the sun was an integral part of the elaborate cult of Mithras (q.v.). The ancient Egyptians worshiped the sun god Ra. In ancient Greece the deities of the sun were Helios and Apollo (qq.v.). The worship of Helios was widely spread. He had temples in Corinth, Argos, Troezen, Argolis, and many other cities; but the principal seat was at Rhodes, where four white horses were sacrificed annually to him. A similar sacrifice was offered in his honor on the summit of Mount Taygetus (Hagios Elias) in Laconia. In time, virtually all the functions of Helios were transferred to the god Apollo, in his identity

as Phœbus Sun worship persisted in Europe even after the introduction of Christianity, as is evidenced by its disguised survival in such traditional Christian usages as the Easter bonfire and the burning of the Yule log on Christmas day See EGYPTIAN RELIGION, FIRE WORSHIP, GREEK RELIGIOUS MYTHOLOGY, INDIAN MYTHOLOGY, ROMAN RELIGION

**SUN YAT-SEN, SUN WEN, or CHUNG SHAN** (1866-1925), Chinese nationalist revolutionary leader and founder of the Chinese republic, born in Hsiang Shan, near Macao, and educated in Chinese village schools, in Hawaii, and in medical colleges in Canton and Hong Kong After joining the republican movement, he was implicated in a revolutionary conspiracy in 1895 and fled abroad to save his life Until 1911 he lived in exile in Hawaii, the United States, Japan and England, sponsoring antimonarchist and pro-republican propaganda activities in China and among Chinese living abroad He was kidnaped in London in 1896 and held a prisoner in the Chinese legation there but was liberated shortly afterward, following intervention in his behalf by the British government During the widespread antipathy to the Manchu dynasty of China which followed the crushing of the antiforeign rebellion of the Boxers (qv) in 1900-01 Sun Yat-sen endeavored, unsuccessfully, to foster the establishment of a republic

About 1900 he began the formulation of political and social doctrines combining elements of European and Chinese ideals As developed in his writings and lectures in subsequent years, Sun Yat-sen's doctrines pivoted on his celebrated *Three Principles of the People* These principles were "nationalism, democracy, and people's livelihood" According to the principle of nationalism China was to become a unified nation with full sovereignty and was to be the equal of other nations in international relations Sun Yat-sen's conception of democracy was that of a republican government based on universal suffrage and exercising the executive, legislative, and judicial powers common to American and western European democracies, but comprising, in addition, two branches based on old Chinese institutions These branches were to be a civil service division for the selection of public officials and a censorship division for the "impartial scrutiny" of the actions of officials and, if necessary, for their impeachment By the principle of people's livelihood, Sun Yat-sen meant the enactment of legislation regulating private capital, pro-



A me Photo

Sun Yat sen

vision of food, shelter and clothing for all the people, and co operation by capital and labor He rejected the theories of class struggle and historical materialism of the revolutionary communist Karl Marx (qv) and after the establishment of the Soviet state in Russia in 1917-18 he rejected Soviet communism as unsuited to Chinese conditions

After 1905 Sun Yat-sen was successful in organizing secret revolutionary groups in China and the monarchic Chinese government offered a reward of almost a half million dollars for his apprehension and execution In 1911 while still abroad he founded the Kuomintang ("Nationalist People's Party"), which during the revolution of 1911, was the decisive factor in establishing a republic to succeed the overthrown Manchu dynasty, see CHINA The Republic Following his return to China, Sun Yat-sen was installed, at Nanking, as provisional president of the new republic in January 1912 In the following month, the emperor abdicated and appointed Yuan Shih-k'ai (qv), his former imperial minister, to replace the monarchy with a republic Realizing that he could not secure the united support of China, Sun Yat-sen resigned as president and accepted the post of director general of transport and trade in the government of Yuan Shih-k'ai

However, the proanarchist policy of the latter estranged Sun Yat-sen, who led the Kuomintang in establishing, in 1917, the Republic of South China, with its capital in Canton in the province of Kwangtung.

He was president of the southern Chinese republic for a brief period after its inception and again in 1921-22. On both occasions he was forced out of office by the military leaders of the republic. From 1923 until his death he was recognized as the chief executive of Kwangtung Province in the Republic of South China, but his authority was virtually confined to Canton, where he was supported by the workers and poor people of the city generally. In 1923 Sun Yat-sen began co-operating with the communist movement; with his approval, Michael Borodin (q.v.), secret emissary of the Communist International, reorganized the Kuomintang in preparation for revolutionary struggles, and in 1924, at the first national congress of the Kuomintang, presided over by Sun Yat-sen, the Communist Party of China was admitted to membership in the Kuomintang. Sun Yat-sen died of cancer. In later years he was revered as the founder of the Chinese republic.

**SUONADA**, or the Inland Sea of Japan, body of water separating the islands of Kyushu and Shikoku from the main island, Hondo. It is about 250 m. in length from the strait of Shimonoseki to Osaka. Its greatest breadth is about 50 m., and it has many islets and rocks.

**SUPAN**, ALEXANDER (1847-1920), Austrian geographer, born in Innichen, Tirol, and educated at the universities of Graz, Vienna, Halle, and Leipzig. He taught geography at Laibach, Czernowitz, and elsewhere. In 1884 he took up residence in Gotha, and there became editor of *Petermanns Geographische Mitteilungen*, one of the foremost geographical magazines of the time, established in 1855 by the German geographer August Heinrich Petermann (1822-78). Supan contributed frequently to the periodical and was also the author of *Grundzüge der Physischen Erdkunde* (1884), *Geographie von Oesterreich-Ungarn* (1889), and other works on geography.

**SUPERCHARGED ENGINE**, an engine with a mechanical device, the "supercharger", for increasing the cylinder charge beyond that normally taken in at existing atmospheric pressures and temperatures.

**Centrifugal type**, a supercharging device equipped with one or more rotating impellers generating centrifugal force utilized for the

compression and transmission of the air against resistance.

**Positive-driven type**, a supercharger driven at a fixed speed ratio from the engine shaft by gears or other positive means.

**Rotary-blower type**, a supercharging device comprising one or more relatively slow-speed rotors revolving in a stationary case in such a way as to provide a positive displacement.

**Turbo type**, a supercharger driven by a turbine operated by the exhaust gases from the engine.

**SUPERCOOLING**, term applied to the cooling of a liquid under special conditions. If a liquid in a perfectly clean vessel has its temperature reduced very slowly to its freezing point and below, it is found that it does not begin to solidify until a temperature some degrees below its normal freezing point is reached. Compare FUSION.

**SUPER-DREADNOUGHT**, prewar term for a type of battleship, which represented an advance on the Dreadnought type in having a larger displacement, thicker armor, heavier guns, and other developments. The first vessel of this type, the *Orion*, was launched for the British navy in 1910.

**SUPEREGO**, in psychoanalytic theory, one of the three basic constituents of the mind, the others being the *id* and *ego* (q.v.). As postulated by the Austrian psychiatrist Sigmund Freud, the term designates the element of the mind which, in normal personalities, automatically modifies and inhibits those instinctual impulses or drives of the *id* which tend to produce antisocial actions and thoughts. In a socially adjusted personality the opposing influences of the *id* and *superego* are in balance, allowing the individual to fulfill his instinctual needs to the extent that they do not destructively violate the environmental social and moral codes by which he has been conditioned. When the inhibitory functions of the *superego* are excessive, this balance is disrupted and normal impulses may be repressed, i.e., forced into the subconscious, thereby resulting in neurotic or psychotic symptoms; see PSYCHOLOGY, ABNORMAL; PSYCHOANALYSIS.

According to psychoanalytic theory, the *superego* develops as the child gradually and unconsciously adopts the values and standards, first of his parents, and later of his social environment. According to modern Freudian psychoanalysts, the *superego* includes the positive ego image, or "ego ideal" which an individual has of himself.

**SUPEREROGATION, WORKS OF,** class of good works described in the Roman Catholic system as not absolutely required of each individual as conditions to salvation. The teaching that it is meritorious to perform such acts is condemned by Article XIV of the English Book of Common Prayer.

**SUPERFETATION,** the circumstance of two distinct conceptions occurring at a considerable interval, so that two fetuses of different ages may coexist.

**SUPERFINISHING,** technique of producing an extremely smooth finish on a metal or other surface by the use of abrasives (qv). Superfinishing can be classified generically as a form of grinding (qv). The exact technique used in superfinishing metal parts is complicated but consists in general in applying abrasive stones to the part to be finished with a low speed of rotation or other motion and with low pressure between the stone and the work. Superfinishing is used to remove the irregularities caused by machining and grinding operations on parts, such as bearings and pistons, which are subject to a large amount of friction.

**SUPERHEAT,** amount by which the temperature of the gas in the envelope or gas cells of an aerostat is higher than the temperature of the surrounding air. If the gas has a lower temperature, the superheat is said to be negative.

**SUPERHETERODYNE,** a radio receiving circuit originated by the American inventor Edwin Howard Armstrong in 1918. The superheterodyne circuit is the basis for almost every type of receiver used in the reception of amplitude-modulated, frequency-modulated, and television signals. The principle of the superheterodyne receiver is the amplification of a beat frequency which is of lower frequency than the original signal received. The beat frequency is produced by the action of a local oscillator tuned in synchronization with the first amplifying stage of a receiver, so that any signal received is automatically transformed to a signal of a given *intermediate frequency*. The intermediate-frequency amplifier may be designed for highest efficiency, because it is required to amplify a signal of only one frequency. The superheterodyne receiver is equipped with an amplifying stage which both amplifies the signal and also "mixes" with it a lower-frequency signal produced by a local oscillator. The difference between the two signals is the intermediate frequency. In a receiver having a

typical intermediate frequency of 465 kilocycles the amplifying or "mixer" stage is tuned to 1560 kilocycles and the local oscillator to 1095 kilocycles, producing a 465 kilocycle beat frequency. The signal produced by the beating of the original signal and the local oscillator is then amplified and detected or demodulated in the conventional manner; see *ELECTRONICS*. For the reception of high-frequency signals double superheterodynes are sometimes employed. In such receivers a first local oscillator and mixer generate a first intermediate frequency which is then amplified by a fixed-frequency amplifier. The amplified signal is then mixed with the output of a second oscillator, producing a second intermediate frequency which is further amplified.

**SUPERIOR,** an unincorporated town of Pinal Co., Ariz., situated about 60 miles E.S.E. of Phoenix. It is served by a railroad, and is in the heart of a productive copper-mining region. The principal crops of the area, which is irrigated in part, are cotton, alfalfa, citrus fruits, and garden truck. Four miles W. of the town is the Southwestern, or Thompson, Arboretum, founded by William Boyce Thompson (1869-1930), a mine operator who also founded the Boyce Thompson Institute for Plant Research at Yonkers, N.Y. The arboretum contains numerous varieties of plants from all over the world. Pop. (1950) 5500.

**SUPERIOR,** city of Nuckolls Co., Nebr., situated on the Republican River, 12 miles S. of Nelson. It has grain and lumber interests. Pop. (1950) 3227.

**SUPERIOR,** county seat and port of entry of Douglas Co., Wis., situated at the W. end of Lake Superior, about 330 miles N.W. of Madison, and opposite Duluth, Minn., with which it is connected by several bridges. It is served by six railroads and by lake steamers, and maintains a municipal airport. Superior ranks second among U.S. ports in point of tonnage, and, with Duluth, ranks first among the Great Lakes ports. The harbor, with about 30 m. of water frontage, comprises three connecting harbors, Lake Superior and the bays of Allouez and St. Louis. Facilities of the port include the largest iron-ore docks in the U.S. and one of the largest grain elevators in the world, in addition to numerous coal docks and other grain elevators. Chiefly grain, iron and copper ore, and coal are shipped from the port of Duluth-Superior. The city is a leading grain market, and an important manufactur-

ing center and distribution point. Among the industrial establishments are extensive coal-briquet plants, railroad shops, shipbuilding yards, ironworks, sawmills and planing mills, flour mills, canneries, plants processing dairy products, and factories manufacturing railroad engines and cars, heavy machinery, sash and doors, wooden boxes, sewer pipe, concrete, furniture, windmills, and door catches.

Superior is the site of a State teachers college, established in 1895. The site of the present city was probably visited by French explorers about 1661, and about 1678 a trading post was established there by Daniel Greysolon, Sieur Duluth. The Hudson's Bay Company established a fur-trading post on the site in 1820 but permanent settlement was not effected until 1852, in which year the town was laid out by a group of investors including Senator Stephen A. Douglas of Illinois, for whom the county was named. Superior was chartered as a city in 1889. Pop. (1950) 35,325.

**SUPERIOR, LAKE**, one of the largest bodies of fresh water on the globe. It is the highest and most western of the Great Lakes, lying between Canada and the United States. It is bounded on the north and east by Ontario, on the south by Michigan and Wisconsin, and on the northwest by Minnesota. Its greatest length is 420 m.; greatest breadth, 167 m.; area, about 31,500 sq.m. The surface of the lake is 602 ft. above sea level, and its average depth about 900 ft.; its maximum depth is 1008 ft., or 406 ft. below sea level. Its surface has an elevation of 22 ft. above that of lakes Huron and Michigan; this difference occurs in the rapids of St. Mary's River, the only outlet (see SAULT STE. MARIE), where the average discharge is 86,000 cu.ft. per second.

Lake Superior receives no rivers of importance, although hundreds of small rivers pour themselves into it, the largest being the St. Louis and the Nipigon. Its aggregate drainage area is 80,400 sq.m. Near Dog Lake (318 m. east of Port Arthur) a short portage connects streams flowing to Lake Superior with others flowing north to Hudson Bay. The Sault Ste. Marie Canal ( $\frac{3}{4}$  m., opened 1895) gives continuous navigation from the head of Lake Superior to the sea, 2384 m.

The bold northern coast is fringed with rocky islands, some rising from deep water to 1300 ft. above the lake. The largest island is Isle Royale, which is 44 m. long. The southern shore is generally lower and more sandy, with occasional ridges of limestone. Kewee-

naw Point projects far into the lake. At Grand Isle Bay, about 100 m. west of Sault Ste. Marie, are the Pictured Rocks, cliffs of sandstone from 50 to 200 ft. high, in many places presenting fantastic forms, and marked by numerous vertical bands and blotches of red and yellow. The boundary line between Canada and the United States is drawn through the center of the lake from its outlet to the mouth of Pigeon River, but is diverted so as to include Isle Royale in the United States.

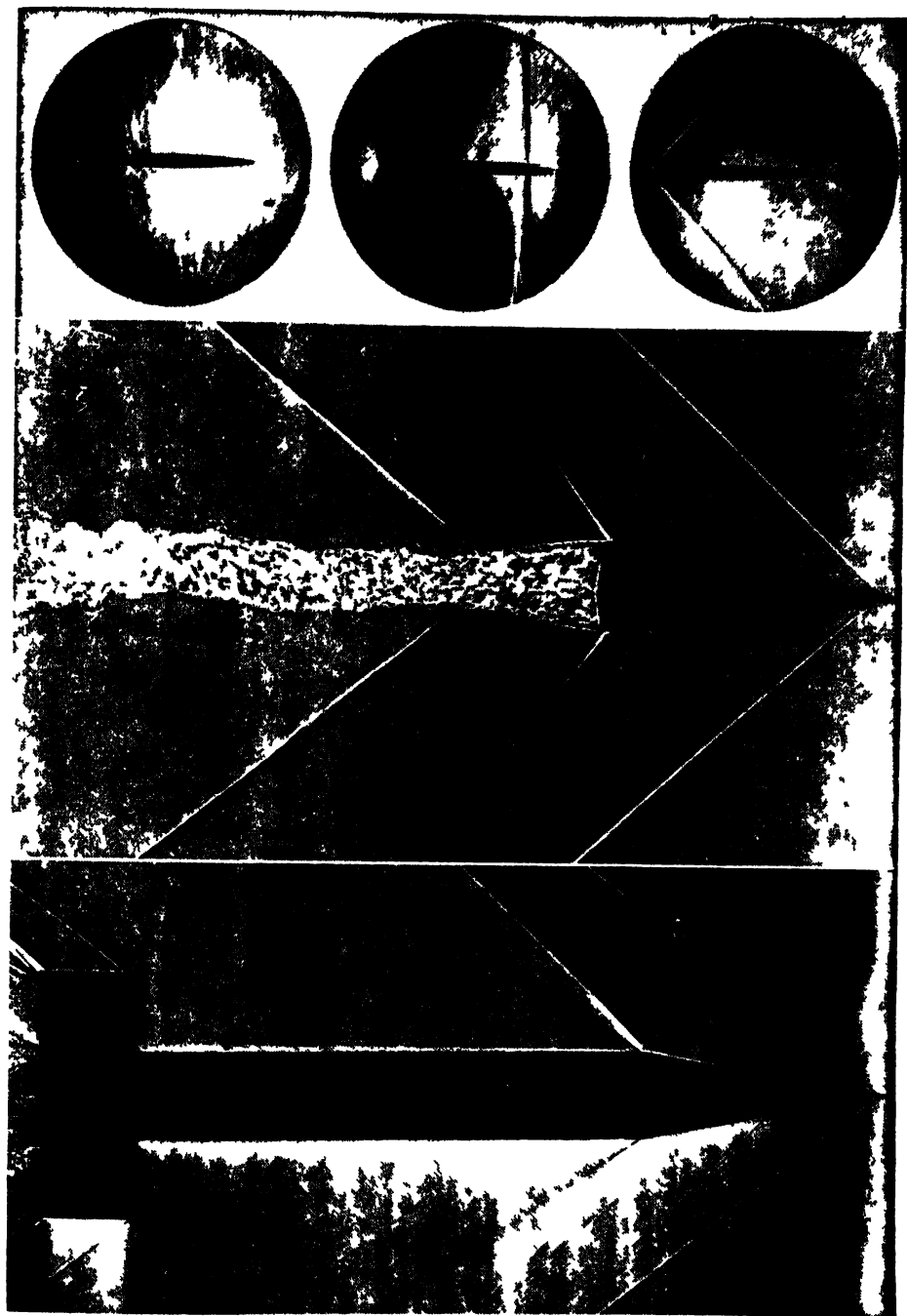
The water of Lake Superior is singularly pure and transparent. It never freezes over, but the shore ice prevents navigation in winter. The lake also is subject to violent storms; waves have been observed, during protracted autumn gales, 15 to 18 ft. high. It has the small tides common to the great lakes, and also *seiches*.

The rocks belong principally to the Laurentian and Huronian systems of the Azoic series, overlaid in some places, especially on the south side, with patches of the Lower Silurian (soft sandstones). There is everywhere much evidence of glacial action. The country surrounding the lake is rich in minerals, and large veins of copper and iron traverse its bottom from the southern shore.

**SUPERPHOSPHATE**, or ACID PHOSPHATE, a soluble salt of phosphoric acid (q.v.), important in horticulture as an ingredient of phosphate fertilizers. The cheapest and most widely used superphosphate is calcium dihydrogen phosphate,  $\text{Ca}(\text{H}_2\text{PO}_4)_2$ , made by combining calcium phosphate rock,  $\text{Ca}_3(\text{PO}_4)_2$ , with sulfuric acid. Calcium sulfate,  $\text{CaSO}_4$ , produced as a by-product of the reaction, is used to produce, by the addition of water, a mixture of dry salts known commercially as *superphosphate of lime*.

**SUPERSONICS**, a term used to designate two distinct branches of physics. 1. Supersonics, in its original sense, applied to the branch of physics, now sometimes called ultrasonics, dealing with waves similar to sound waves, but having a frequency too high for detection by the human ear. The waves are directional (like ultrashort radio waves), and obstacles in their path cast shadows of sound, just as material objects in the path of light waves or short radio waves cast shadows, and prevent reception of the waves, or signal, unless the direct line from the source of the signal to the receiver is clear of interference. Supersonic waves, or ultra-auditory sound, are used in several biological and physical applications. Although





VACA Photo On In use Dept U S Army

SUPERSONICS Top Spark photograph of projectiles in subsonic, transonic, and supersonic flight Middle Spark photograph of a pure cone projectile,  $M=1.494$  Bottom A spark photograph of a finned configuration in supersonic flight,  $M=1.7$

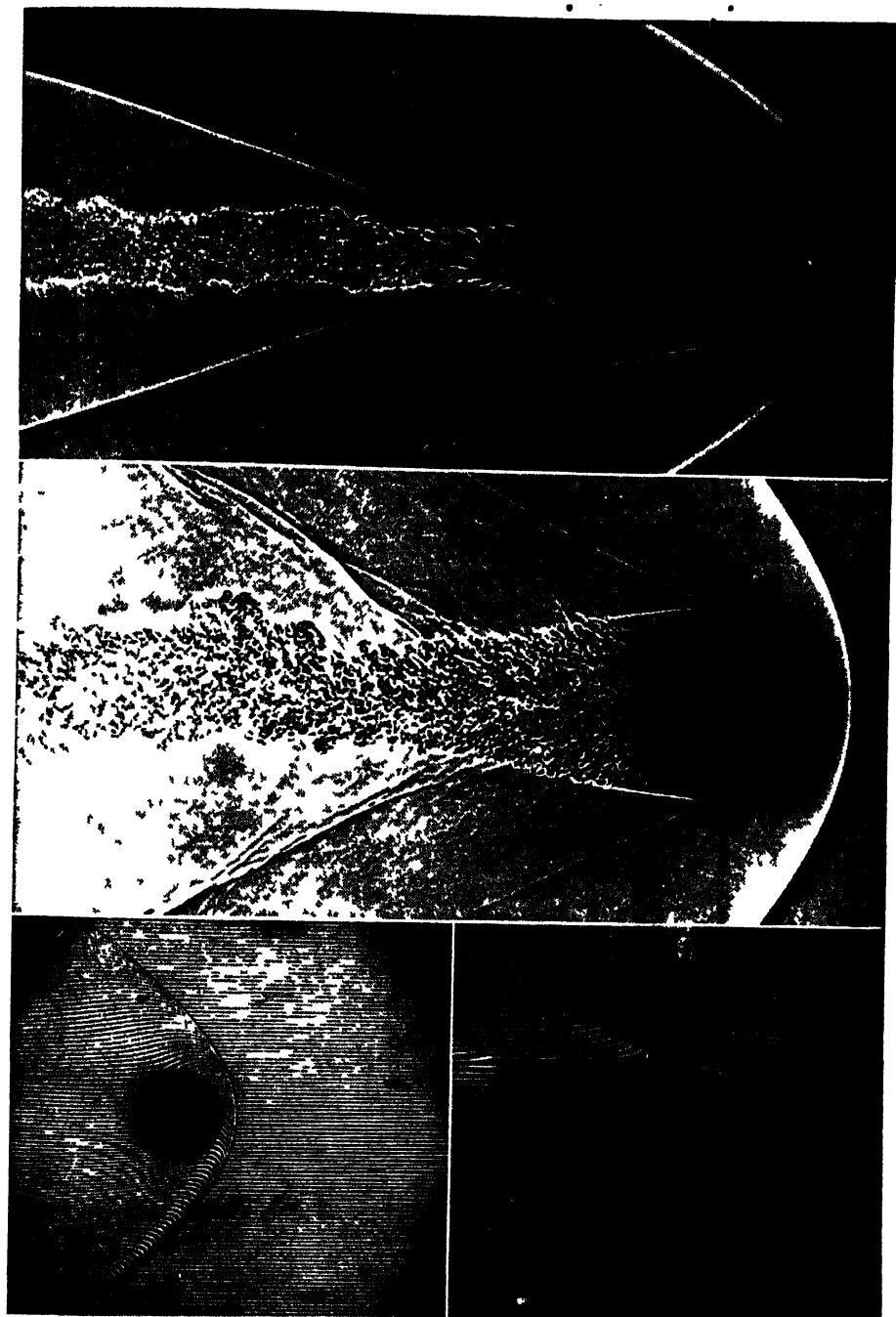
the waves are inaudible, they have a distinct effect on the human nervous system, causing unpleasant reactions without the corresponding physical sensation. Such waves are used for the sterilization of biological fluids, the supersonic waves literally shaking apart any pathogenic bacteria in the fluid. They are also used in the testing of the continuity of molded, cast, or extruded physical shapes. During World War II, for example, the production of grains of rocket powder was of prime importance. Such grains were 2 to 6 inches in diameter and 2 to 6 feet long. Any flaw in the grain would cause faulty burning, and probably a bursting of the rocket motor with consequent injuries to personnel. When the process of extruding rocket powder grains was first established, the importance of inspection required that each grain be X rayed for flaws. Production of rocket powder was so great that the inspection of the product by X ray required the use of almost three fourths of the entire nation's output of photographic paper. In order to eliminate the excessive use of photographic paper, a system of testing by supersonic waves was developed: the powder grains were subjected to supersonic vibrations under water; normal grains gave no response, but flawed grains gave distinctive reactions indicating the nature and extent of the flaw. Other applications of this branch of supersonics include dog whistles which are too high in pitch (q.v.) for the human ear but can be heard by dogs.

2. Supersonics, in its present sense, indicates the branch of physics dealing with the problems and phenomena arising when a solid body exceeds the speed of sound in the medium in which it is traveling; usually the medium is air. The speed of sound in air is dependent upon several factors, including the temperature, humidity, density, and altitude. Because the speed of sound, being thus variable, is a critical factor in aerodynamic equations, it is represented by a *Mach number*. The Mach number is the speed of the projectile or plane with reference to the ambient atmosphere, divided by the speed of sound in the same medium and under the same conditions. Thus, at sea level, under standard conditions of humidity and temperature, a speed of about 760 miles per hour represents a Mach number of one, that is,  $M=1$ . The same speed in the stratosphere, because of difference in density and temperature, would correspond to a Mach number of  $M=1.16$ . By designating speeds by Mach number,

rather than by feet per second, or miles per hour, it is possible to obtain a more accurate representation of the actual conditions encountered in flight.

Studies of artillery projectiles in flight, by means of spark photographs, disclose the nature of the atmospheric disturbances encountered in supersonic flight. A series of such photographs were taken at the United States Army Ordnance Research Center at Aberdeen, Maryland, which disclosed the following characteristics of flight. At subsonic speeds, that is, below  $M=0.85$ , the only atmospheric disturbance shown was a turbulence in the wake of the projectile. In the transonic range, from  $M=0.85$  to  $M=1.3$ , shock waves appear as speed increases; in the lower part of this speed range shock waves arise from abrupt breaks in the smooth contour of the projectile. As the speed passes  $M=1$ , shock waves arise from the nose and tail and are propagated from the projectile in the form of a cone, which has an apex angle inversely proportional to the speed of the projectile. Thus, at  $M=1$ , the nose wave is essentially a flat plane; about  $M=1.14$  (1064 miles per hour at sea level) the angle of the cone is about  $90^\circ$ ; and at the maximum velocity recorded in the photographic series,  $M=2.48$  (about 1900 miles per hour), the shock wave preceding the projectile has a conical angle of slightly less than  $50^\circ$ . This line of research has already made possible the design of modern high-speed airplanes, in which the wings are swept back at angles as great as  $60^\circ$ , to avoid the shock wave from the nose of the plane.

Other factors determined by research in the supersonic range of speeds of artillery projectiles include the shape of the projectiles and the rate of gas flow. The "tear drop" shape, which is the ideal streamlined shape for subsonic speeds, is extremely uneconomical in the supersonic range, because of the large frontal surface which must compress the atmosphere and give rise to energy-destroying shock waves of great amplitude. When gaseous flow takes place through a constricted tube, such as a rocket nozzle, at subsonic speeds (see *VENTURI*), the speed of the flow increases and the pressure decreases in the throat of the constriction. The opposite phenomena take place at supersonic speeds; speed of flow increases in a divergent tube: hence, the exhaust gas of a rocket, increasing to supersonic speeds in the throat of a venturi tube or rocket nozzle, further increases its speed and consequent thrust in the



Ordnance Dept., U. S. Army

**SUPERSONICS.** *Top* Spark photograph of sphere in supersonic flight,  $M=4.01$  *Middle:* Spark photograph of a sphere in which  $M=17.6$  Shock waves are shown to be considerably less. *Bottom.* Interferometer pictures showing difference in shock waves of spheres and cones.

diverging flare of the nozzle, thereby multiplying the efficiency of the rocket system. Another factor, long known to rocket designers, is the direct influence of ambient atmospheric pressures on the efficiency of the flight of planes in supersonic speed ranges; that is, the closer the surrounding medium is to a perfect vacuum, the more efficient is the power plant of the plane. The range of the supersonic plane can also be increased by reducing the area, or cross section, displacing atmosphere. Increasing the weight by increasing the length, but, at the same time making the plane more slender, and equipping it with a needle nose, are necessary features of design for planes operating in the supersonic range in atmospheric media. In the years following World War II, the United States Air Forces and the United States Navy established research institutions which included among their facilities wind tunnels (q.v.) capable of testing plane models and airplane parts in currents of air traveling at supersonic speeds.

**SUPERSTITION**, term employed to designate beliefs and usages not consonant with accepted notions of reality and possibility. Examples: the "evil eye" of the *jettatore*; emblems of good luck, such as the horseshoe in the U.S.; methods of mantic divination, as, for instance, cartomancy, by playing cards; capnomancy, by smoke from an altar; catoptromancy, by mirrors; chiromancy, by the hand; clodoni-mancy, by certain lucky or unlucky words; clidomancy, by keys; coccinomancy, by snails; dactylomancy, by suspended rings; gastromancy, by ventriloquism, or by a vial of water; geomancy, by geometrical figures; gyromancy, by walking in a circle; lithomancy, by precious stones, or pebbles; myomancy, by mice; and onomancy, by letters forming the name of a person.

**SUPPÉ, FRANZ VON** (1820-95), Austrian composer of light opera, born in Spalato in Dalmatia. He was Kapellmeister successively at the Josephstädter Theater, the Theater an der Wien, and from 1865 until the end of his career at the Leopoldstädter Theater. He was a prolific composer. The most important of his works include the operetta *Die Schöne Galathea* (1865), *Fatinitza* (Vienna, 1876), and *Boccaccio* (1879). One of his most popular overtures is *The Poet and Peasant*.

**SUPPLE JACK**, name given in the southern United States to the *Berchemia volubilis*, a twining shrub of the Rhamnaceae family, which is found as far north as Virginia.

**SUPPLEMENTARY PROCEEDINGS**, in legal practice and procedure in the United States, a legal remedy, provided in those States, with codes of civil procedure, by which proceedings may be instituted by a judgment creditor to discover property of a judgment debtor and to apply it to the satisfaction of the judgment. The proceedings are commenced with an application by the creditor to the court for an order to examine the judgment debtor or a third party who is in possession of a judgment debtor's property. The creditor must show that execution (q.v.) on the judgment has been returned wholly or partly unsatisfied. The order directs the debtor to appear and submit to an examination under oath as to his assets. The creditor is permitted to examine the debtor as to his earnings and all transfers of property made by him, with a view to discovering whether the debtor has an income which may be garnished (see GARNISHMENT), or whether he has fraudulently transferred or concealed his property. If the examination discloses that the debtor has in his possession or control property that can be sold under an execution or that a third party has property belonging to a debtor, the court orders the property to be delivered to a sheriff or a receiver.

**SUPPLY AND DEMAND**, in economics, the basic factors determining price. According to the theory, or law, of supply and demand, the market prices of commodities and services are determined by the relationship of supply to demand. Thus, an excess of supply over demand causes sellers to lower prices in order to stimulate sales, and an excess of demand over supply leads buyers to bid prices up as they compete to obtain goods. It should be noted that the terms "supply" and "demand" do not mean the amount of goods and services actually sold and bought; in any sale the amount sold is equal to the amount bought, and such supply and demand, therefore, is always equal. In economic theory, "supply" is the amount available for sale at a specified price, and "demand", sometimes called "effective demand", is the amount purchasers are willing to buy at a specified price.

The theory of supply and demand takes cognizance of the influence on prices of such factors as an increase or decrease in the cost of production, but regards that influence as an indirect one, because it affects prices only by causing a change either in supply, demand, or both. Other factors indirectly affecting

price include changes in consumption habits, such as a shift from natural-silk to artificial-silk fabrics and garments, and the restrictive practices of monopolies, trusts, and cartels. In the view of many economists, the multiplicity of such indirect factors is so great that the terms "supply" and "demand" are, in reality, inclusive categories of economic forces affecting prices, rather than precise primary causal factors. The price-determining mechanism of supply and demand is operative only in economic systems in which competition is largely unfettered. Increasing recourse, in recent times, to governmental regulation of economy has tended to restrict the scope of the operation of the supply-and-demand mechanism. It was greatly restricted in the United States and other countries by governmental price fixing and rationing during World War II, and has been virtually eliminated in such countries as the Union of Soviet Socialist Republics, in which the economy is planned and controlled by the state.

**SUPPOSITORY**, a medical preparation consisting of a capsule, sphere, or cylinder compounded of a vehicle such as cocoa butter, glycerine, or gelatine containing medication. Suppositories are designed for insertion into a body opening (for example the anus, vagina, or urethra), in which the vehicle is gradually melted by the heat of the body, and the medication released from the vehicle and absorbed by the body. A suppository differs from a bougie (q.v.) in that the suppository is left in place for complete absorption or elimination, whereas the bougie is generally fashioned on a solid core of metal or fabric which must be removed after the medication is absorbed.

**SUPPURATION**, morbid process which gives rise to the formation or discharge of pus. After irritation of tissue, white blood cells escape into the neighboring tissue after passing through the walls of the blood vessels, and become pus cells. If they escape to the surface and there is an open wound, the wound is said to suppurate. If they are confined to a circumscribed area below the surface, the collection of pus cells and broken down tissue is called an abscess (q.v.).

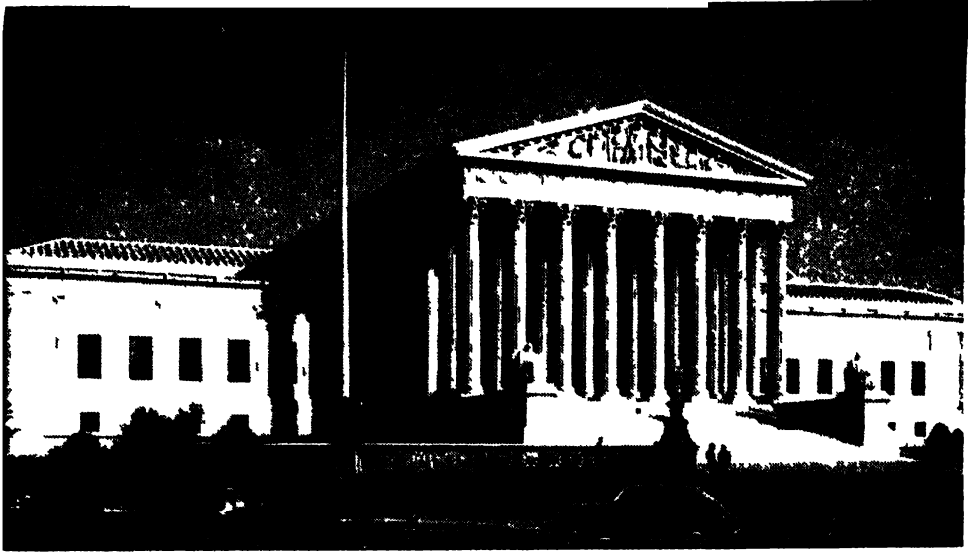
**SUPRARENAL GLAND**, or **ADRENAL GLAND**, vital organ situated, in man, near the upper end of each kidney, and comprising an inner portion, called the medulla, and an outer portion, called the cortex. Each part of the gland consists of a different type of tissue and performs different functions. The adrenal medulla, composed of chromaffin tissue, se-

cretes the hormone adrenalin (q.v.) at times of emotional stress in response to the stimulation of the sympathetic nervous system. It is not indispensable to the organism.

The adrenal cortex, consisting of interrenal tissue and embryologically related to the reproductive system, secretes various hormones, including cortisone (q.v.) and hydrocortisone. These substances, which are essential for life, are chemically similar to the hormones secreted by the reproductive organs. Numerous other cortical substances have recently been isolated, but their functions are not clearly defined. The adrenal cortex has various functions in man, notably the regulation of mineral and organic metabolism, the maintenance of fluid balance, and the inhibition of allergic manifestations and other hypersensitivity responses. Disturbances of the suprarenal glands may result in Addison's disease (q.v.). See **ACTIV; HORMONES**.

**SUPREMACY, ROYAL**, in English history, the doctrine advocating the sovereignty of the English monarch over the established church of England. This doctrine was first advanced by King Henry VIII (q.v.), who in 1534 caused the enactment by Parliament of the Act of Supremacy, whereby the supremacy of the pope in ecclesiastical matters was abrogated and the king of England was declared to be the "only supreme head on earth of the Church of England." The Act of Supremacy was repealed in 1554, during the reign of Queen Mary (q.v.), but a new act, substantially re-enacting that of Henry VIII, was passed in 1559, during the reign of Queen Elizabeth I. Formerly, all members of both houses of Parliament were required to take the Oath of Supremacy, affirming the sovereignty of the Crown over the Anglican Church. This requirement was modified and later, in effect, removed by the Promissory Oaths Act of 1868 and the Oaths Act of 1888, respectively; under those enactments members of Parliament swear allegiance to the Crown but need not attest their belief in the doctrine of royal supremacy.

**SUPREME COURT OF JUDICATURE**, in the judicial system of England, the highest court of justice created under the Judicature Acts of 1873 and 1875, as a consolidation of the previously existing superior common-law and equity courts. The two branches of the Supreme Court of Judicature are the High Court of Justice and the Court of Appeal (qq.v.). The High Court of Justice exercises the jurisdiction formerly lodged with the King's Bench, Common Pleas, Exchequer,



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*The United States Supreme Court Building in Washington, D.C.*

Chancery, Admiralty, Probate and Divorce Courts, and also jurisdiction over appeals from inferior courts. The Court of Appeal has jurisdiction of appeals from the High Court of Justice. See COURTS.

**SUPREME COURT OF THE UNITED STATES, THE,** the highest court in the national judiciary established by the Constitution. Its jurisdiction is described therein as follows: "the judicial power shall extend to all cases in law and equity arising under this Constitution, the laws of the United States, and treaties made, or which shall be made, under their authority; to all cases affecting ambassadors, other public ministers and consuls, to all cases of admiralty and maritime jurisdiction; to controversies to which the United States shall be a party; to controversies between two or more States, between a State and citizens of another State, between citizens of different States, between citizens of the same State claiming lands under grants of different States, and between a State or the citizens thereof and foreign states, citizens or subjects. In all cases affecting ambassadors, other public ministers and those in which a state shall be party, the Supreme Court shall have original jurisdiction. In all the other cases before mentioned, the Supreme Court shall have appellate jurisdiction, both as to law and fact, with such exceptions and under such regulations as the Congress shall make."

The appellate jurisdiction may be operated into two divisions, one over State courts, the other over the inferior Federal courts. With respect to the former the Supreme Court reviews the final judgment rendered in any case by the highest court of the State to which the case and a State practice can be carried. In addition the Supreme Court is given power to issue writs of prohibition and all other writs necessary for the exercise of its jurisdiction and agreeable to the principles and usages of law. Thus it has complete supervision and control over all the inferior courts of the United States.

Only there were two parties in the country, one believing that the new government was but a continuance of the old confederacy—a league of States, the State remaining dominant and the national government serving only as a limited agency for transacting matters of general importance; the other that a new nation was created, supreme with powers of a nation, the States being simply parts. By one party the provisions of the Constitution were strictly construed, no power was vested in the national government except that expressly named. The other believed the Constitution was to be so construed as to give vigor and efficiency to the nation. The question was finally settled by the Supreme Court, which has always spoken for the nationality of the United



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THE SUPREME COURT WHICH UPHILLED THE 18TH (PROHIBITION) AMENDMENT. Seated, left to right: William R. Day, Joseph McKenna, Edward D. White (Chief Justice), Oliver Wendell Holmes, Willis Van Devanter. Standing: Louis D. Brandeis, Mahlon Pitney, James C. Reynolds, John H. Clarke.

States. In *Chisholm, executor, vs. Georgia*, decided Feb. 18, 1793, the court held that an action might be maintained against a State by a citizen of another State. As a consequence the Eleventh Amendment was adopted, which in effect forbids an action in the Federal courts against a State by an individual.

Under Chief Justice John Marshall, between 1801 and 1835, came those decisions which, by declaring the relative powers of the nation and the State, disclosed the full significance of the Constitution as an instrument expressing the creating of a new nation and demonstrated the value of the Supreme Court in determining the extent of such relative powers and in passing upon acts of State and nation. In *Marbury vs. Madison*, decided Feb. 24, 1803, it was held that an Act of Congress repugnant to the Constitution was void and that it was the function of the court to ascertain in cases properly before it whether such repugnancy exists. This power of the courts, though often criticized, especially in recent years, has never been shaken.

The next important decision was *M'Culloch vs. Maryland*, in which the question was presented of the power of Congress to charter a national bank. The Constitution gives in terms no such power, or any power to create corporations, and advocates of strict construction contended that Congress

could not create a corporation for any purpose. The court, upon the authority of that clause which, following the clauses making express grants to Congress, empowers that body to "make all laws which shall be necessary and proper for carrying into execution the foregoing powers", held that, as a bank was a proper and convenient agency for carrying on the fiscal affairs of a government, there was power in Congress to create a banking corporation; that the word "necessary" was not to be construed in a strict and narrow sense, but, viewing the Constitution as an organic instrument, which from the very necessities of the case used general terms in giving to that government the power essential for its being—to be taken broadly and liberally, and declared what has become axiomatic in constitutional law: "Let the end be legitimate, let it be within the scope of the Constitution, and all means which are appropriate, which are plainly adapted to that end, which are not prohibited, but consistent with the letter and spirit of the Constitution, are constitutional."

This decision laid the foundation of what is known as the doctrine of implied powers, well appreciated when we recall that under a grant of power stated in the few words "to establish post offices and post roads" the great postal system of the United States has been built up. In the same term was decided the case of the *Trustees of Dartmouth Col-*

lege vs. Woodward, in which it was held that the charter of a private corporation granted by a State created a contract whose obligations the State could not impair, because of that provision of the Federal Constitution which forbids a State to pass any law "impairing the obligation of contracts". Popular disapproval of this decision is indicated by the fact that practically all of the States enacted amendments to their constitutions reserving the power of repeal, alteration, and amendment of all corporate grants.

*Martin vs. Hunter, and Cohens vs. Virginia*, the latter decided in the February term, 1821, settled the power of the Supreme Court to review, and if necessary, set aside, the proceedings of a State court in a case in which a Federal right was asserted by the defeated party. Again, in *Gibbons vs. Ogden*, decided in 1824, the supreme power of the Federal government over the navigable waters of the United States was affirmed. The Constitution having granted to Congress the power to "regulate commerce with foreign nations and among the several States", it was held that that power could not be infringed upon by any action of a State and that a State could not interfere with such commerce even when carried upon waters wholly within its own territory. Upon that decision rests freedom of commerce between the States. In *Osborn vs. United States Bank*, it was held that a State had no power to tax one of the branches of the United States Bank. From that decision comes the rule exempting all agencies and instrumentalities of the national government from State taxation except so far as permitted by Congress.

Chief Justice Marshall was succeeded by Chief Justice Taney, a strict constructionist. In the "Dred Scott Case", decided in 1856, the nationality of the United States was asserted though not satisfactorily to the friends of human freedom, in that it decided that the recognition by the Constitution of slave property carried with it the protection of that property in all U.S. territories.

When the Civil War ended a new series of cases arose. Some stringent laws had been passed against participants in the rebellion. In *Texas vs. White*, decided in 1868, it was held that States in rebellion did not lose their existence or identity. In 1890 came *Leisy vs. Hardin*, which held that a State cannot forbid the sale of liquor in original packages imported from other States. This decision and those following it gave rise to Congressional statutes known as

the Wilson Act and the Webb-Kenyon Act, as a result of which the States may now exercise effective control over the liquor traffic. In 1895, in the *Income Tax Cases*, it was held that the constitutional provision requiring direct taxes to be apportioned among the States according to their population rendered invalid a tax which was not so apportioned on incomes derived from real estate and as the direct product of personal property. This decision led to the passage of the Sixteenth Amendment ratified in 1913 which provides that Congress may levy taxes on incomes without such apportionment among the several States. In the *Insular Cases*, and succeeding cases arising out of the conquest of Puerto Rico and the Philippines, the court considered the power of Congress to govern territories acquired by war or treaty, and affirmed to the largest extent the national power of the republic, holding that a number of the important limitations on congressional action were not applicable to territory not incorporated by Congress into the United States.

Among New Deal measures invalidated by the Supreme Court were: National Recovery Act (1935); Farm Mortgage Moratorium Act (1935); and Agricultural Adjustment Act (1936). New Deal legislation upheld by the Court includes: Gold Repeal Resolution and Gold Reserve Act (1935); Tennessee Valley Authority Act (1936); Second Farm Mortgage Act (1937); National Labor Relations (Wagner) Act (1937); Federal Security Act (1937); and Fair Labor Standards Act (1941).

Later decisions include upholding the right of municipalities to impose canvassing taxes upon religious sects (1942), establishing the validity throughout the 48 States of divorces granted in any specific State (1943); nullification of rulings by which, in several Southern States, Negroes are barred from participating in party primaries (1944); upholding the conviction of eleven communist leaders on charges of conspiracy to teach and advocate violent overthrow of the government (1951); and finding racial segregation in the public schools to be unconstitutional (1954).

Chief Justices since the foundation of the office in 1789: John Jay (1789-95); John Rutledge (1795-96); Oliver Ellsworth (1796-1800); John Marshall (1801-35); Roger B. Taney (1836-64); Salmon P. Chase (1864-73); Morrison R. Waite (1874-88); Melville W. Fuller (1888-1910); Edward D. White (1910-21); William Howard Taft





Republic of the U S of Indonesia

*Street scene in Surabaya capital of East Java Republic of Indonesia*

(1921-50), Charles Evans Hughes (1950-41), Hulin F. Stone (1941-45), Fred M. Vinson (1946-53), Paul Warren (1953-).

**SUPREME HEADQUARTERS ALLIED EXPEDITIONARY FORCE**, the official designation, usually indicated by the initials SHAEF at the high command which directed the Allied invasion of western Europe in World War II and the subsequent conquest of western Germany. SHAEF was created by agreement among the Allies and was established in London on February 15, 1944 under the command of U.S. General Dwight D. Eisenhower. American and British officers predominated among the 15,000 officers and men who composed the staff of SHAEF, the largest military staff ever assembled, also included in the complex organization of SHAEF were French, Belgian, Norwegian and Dutch military personnel. After the liberation of Paris, SHAEF was transferred to Versailles, France, and following the surrender of Germany in May 1945, it was situated in Frankfurt on the Main, Germany, in the offices of the great cartel IG Farbenindustrie. Pursuant to the terms of the agreement creating it which provided for its dissolution within ninety days after the victory over Germany, SHAEF was liquidated on July 14, 1945. Its postwar functions

in Germany were assumed by the Allied Control Council in Berlin, comprising representatives of the United States, the Soviet Union, the United Kingdom, and France.

**SURABAYA** (Du *Soerabaya*) capital and chief port of East Java Province, Republic of Indonesia, and second largest city in population after Batavia of the republic situated on Surabaya Bay, at the mouth of the Kali Mas River, one of the most important commercial and trading centers in the Far East and is the terminus of a railway and highway which connect the city to industrial centers in the interior. The principal articles of trade include sugar, cane, tobacco, coffee, corn, hides, and tapioca. The chief industries are shipbuilding and the manufacture of machine shop products, sugar, laundry products, and furniture. The port of Surabaya consists of a large harbor enclosed by breakwaters and containing floating docks and numerous quay wharves, and warehouses. The city is connected by steamer with the principal ports of the world.

Prior to World War II, Surabaya was the chief Dutch naval station in the East Indies. On March 10, 1942, the city was captured by the Japanese. After the close of the war, Indonesian nationalists seized the city, Java, and other islands and proclaimed the Re-

public of Indonesia on Aug. 17, 1945. With the aid of British Indian troops, the Dutch recaptured Surabaya and concluded a truce with the Indonesians. In Dec., 1948, with the failure of negotiations between the Netherlands and the Indonesian Republic concerning the establishment of the United States of Indonesia, the Dutch again attacked the republic and succeeded in taking Surabaya and all of Java. Under the auspices of a United Nations Commission, the Netherlands concluded a truce agreement with the Indonesian Republic on Aug. 1-2, 1949, which provided for the establishment of a United States of Indonesia pending the election of an Indonesian constituent assembly. See REPUBLIC OF INDONESIA; UNITED STATES OF INDONESIA. Pop. of city, about 390,700.

**SURAT**, capital of a district of the same name, Bombay Province, Union of India, 166 miles N. of Bombay, at the mouth of the Tapti, in the Gulf of Cambay. The Tapti, owing to a sand bar, affords entry only to small vessels, and the commerce of Surat, which from the 16th century to the 18th century was extensive, has been diverted to Bombay. Surat rose into importance as the place from which the Mohammedans of Hindustan embarked on their pilgrimage to Mecca. In 1612 the English East India Company established in Surat their principal trading station in India. Pop. (1941) 171,443.

**SURBITON**, municipal borough of Surrey, England, on the Thames, mainly residential, 13 miles s.w. of London. Surbiton Common witnessed the last stand of the Royalists in the Civil War. Pop. (1951 prelim.) 60,675.

**SURD**, in mathematics, an irrational number or quantity, especially an indicated root that cannot be extracted. In phonetics, a surd is a consonant sound made with the vocal cords so that they do not produce voice or tone, as *p*, *t*, *s*, or *k*.

**SURESNES**, town in the department of Seine, France, 7½ miles w. of Paris. In 1593 a conference was held here which resulted in the adoption of Catholicism by Henry IV. Pop., about 22,000.

**SURETY**. See PRINCIPAL AND SURETY; SURETYSHIP.

**SURETYSHIP**, in law in England and the United States, a contract obligation assumed by one party who agrees to answer for the debt or default of another. The purpose for which a suretyship obligation is assumed is the establishing of security to a creditor for the payment of money or the performance of an obligation by a debtor. The party who

undertakes the suretyship obligation is called the surety; the party to whom the security is given is called the creditor; and the party for whose benefit the security is given, and whose obligation to the creditor is assumed by the surety, is called the principal or the principal debtor. A suretyship obligation is similar to that assumed under a guaranty (q.v.) contract, in that it involves an assumption of liability under a written instrument to a creditor that the debtor's debt will be paid. There is, however, a difference in the relations of the parties between suretyship and guaranty. A surety is bound with the principal on the identical contract under which the liability of the principal accrues. A guarantor becomes bound for the performance of a prior or collateral contract upon which the principal alone is obligated. The contract of the surety is made at the same time and usually jointly with that of its principal, whereas that of a guarantor in a contract distinct from that of his principal. A surety is the insurer of the debt or obligation, whereas a guarantor is an insurer of the ability or solvency of the principal. Consequently, the surety may be joined with the principal as a defendant when the principal is sued for nonpayment of a debt, whereas the guarantor may be sued only after a judgment has been rendered on a suit for nonpayment brought by the creditor against the debtor.

The obligation of a surety is not binding on him when the contract between the primary parties out of which it springs is invalid because it contains illegal provisions or because it is based upon an illegal consideration. For example, a suretyship contract is void and the surety is not liable when it is given for a gambling debt or to defraud the creditors of the principal. Likewise, a surety is not bound by the principal's obligation given to compound a crime.

A surety has rights against the creditor, the debtor, and the cosureties. As against the creditor the surety is relieved of the liability he has assumed if the creditor and the debtor agree, without the consent of the surety, to extend the time for payment by the debtor, or to make any other material change in the contract terms between them. Payment by the debtor to the creditor discharges the surety's obligation. A surety who is sued by the creditor can offset the creditor's claim by any claims that he has against the creditor. In the absence of a specific provision in the contract of surety-

ship to the contrary, the creditor may sue the principal or surety independently in such order as he may see fit, or may sue them jointly.

As against the principal debtor, the surety can demand reimbursement for any loss he has incurred as surety. A surety may settle with a creditor for a smaller amount than the debt originally due from the principal; he can then recover only this amount from the debtor. Any one of a number of co-sureties may pay the principal's debt and recover a proportionate share from the other surety or sureties. Another and very important right of the surety who has paid the principal's debt is the right to receive any securities that the principal may have given the creditor; this is known as the right of subrogation (q.v.).

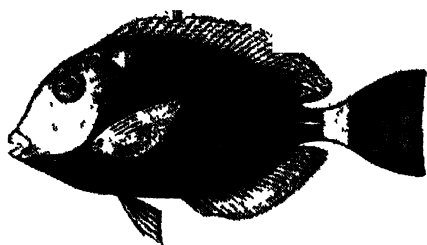
In recent years a number of surety companies have been organized, the principal function of which is to furnish bail bonds, appeal bonds, and bonds for administrators, executors, and receivers. Such bonds are basically surety contracts under which the sureties furnish security for the appearance of a defendant before the court, for his carrying out of the judgment of the court, or for the performance of the legal obligation undertaken by an executor, administrator, or receiver.

**SURFACE**, the boundary between two portions of space. As a point in a plane is determined in general by two intersecting lines, so a point in space is in general determined by three intersecting surfaces. These surfaces may be plane, quadric, or of higher order according as their equations are of the first, second, or higher degree in the linear co-ordinates of the system. Thus in Cartesian co-ordinates (q.v.) the general equation of the first degree in  $x, y, z$ , or  $ax + by + cz + d = 0$ , is represented by a plane. The general equation of the second degree in  $x, y, z$ , or  $ax^2 + by^2 + cz^2 + 2gxy + 2g'xz + 2kx + 2my + 2nz + d = 0$ , is represented by a conicoid, or surface of the second order, also called a quadric surface. By a suitable transformation of co-ordinates the general equation of the second degree may be transformed into one or the other of the forms (1)  $Ax^2 + By^2 + Cz^2 = D$  or (2)  $Ax^2 + By^2 = Cz$ . Surfaces having the symmetric equation (1) are symmetric with respect to the origin as a centre and are called central quadrics. Noncentral quadrics are included in equation (2). If  $A = B = C$ , equation (1) takes the form  $x^2$

$+ y^2 + z^2 = K (= r^2)$ , the equation of the sphere (q.v.). The general equation (1) represents either an ellipsoid or a hyperboloid. If  $D = 0$ , and  $A, B, C$  are not all positive, equation (1) represents a conical surface whose vertex is at the origin. Equation (2) is represented by the surface of a paraboloid.

A surface through every point of which a straight line may be drawn so as to lie entirely in the surface is called a ruled surface. Any one of these lines which lies on the surface is called a generating line of the surface. The cylinder, cone, hyperboloid of one sheet, conoid, and the hyperbolic paraboloid are ruled surfaces. There are two distinct classes of ruled surfaces, those on which the consecutive generators intersect and those on which they do not. The former are called developable and the latter skew surfaces.

If the degree of the equation  $f(x, y, z) = 0$  is higher than the second, the surface representing it will be of an order higher than the second. In discussing the properties of such surfaces, especially the nature of the surface in the vicinity of any given point, the equation of the tangent plane at that point is necessary. This plane is the locus of all tangent lines through the given point, and will meet the surface of the  $n$ th order in a curve of the  $n$ th degree, since each straight line meets this curve in  $n$  points. The point of contact of the plane with the surface will be a singular point on the curve. (See CURVE.) The section of any surface by a plane parallel and infinitely near to the tangent plane at any point is a conic and is called the indicatrix at the point. Thus points of a surface are called elliptic, parabolic, or hyperbolic, according as the indicatrix is an ellipse, parabola, or hyperbola. If every straight line through a point  $(x', y', z')$  of a surface meets the surface in two co-incident points, the point  $(x', y', z')$  is called a singular point. If the tangent lines at any point form a cone the point is called a conical point; if they form two planes the point is called a nodal point. Similar to the envelope of a family of curves, the envelope of a family of surfaces is the locus of the ultimate intersections of a series of surfaces produced by varying one or more parameters of an equation. The curve in which any surface is met by the consecutive surface is called the characteristic of the envelope. Every characteristic will meet the next in one or more points, and the locus of these



Surgeon fish (*Acanthurus hepatus*)

is called the edge of regression or cuspidal edge of the envelope.

**SURFACE TENSION**, property by virtue of which the surface of a liquid tends to contract to a minimum area. It is measured in ergs per square centimeter. See CAPILLARITY.

**SURFBIRD** (*Aphriza virgata*), ploverlike bird found on the Pacific coasts of North and South America, akin to sandpipers and turnstones and sometimes called boreal sand-piper.

**SURF FISH**, fish of the suborder Halconoti and family Embiotocidae, related to the percoids. Many species occur on the Pacific coast of the United States, where they inhabit bays and the surf on sandy beaches. They are small, oval-oblong, compressed, with stripes, spots, and effusions of various colors. They are viviparous.

**SURF SMELT**, small, firm-fleshed fat smelt, *Hypomesus pretiosus*, of the coast of California and northward, valued as food. It spawns in the surf, and is netted in great quantities.

**SURGEON**, one who practices surgery; a practitioner who treats injuries, deformities, or disorders by mechanical and operative procedures. An archaic form of the word "surgeon" is *chirurgion*.

**SURGEON FISH**, or SEA SURGEON, a tropical Oriental fish belonging to the Teuthidiidae family. About eighty species are recognized. The fish feed upon seaweeds. Those best known are of the genus *Teuthis*, called barberos, lancet fishes, and tangs, and characterized by the possession of a long, sharp, lancetlike spine on each side of the caudal peduncle. The spine is movable and shuts into a groove along the side of the tail.

**SURGEONS, AMERICAN COLLEGE OF**, a guild, organized in 1913 by some 500 surgeons of North America representing every branch of surgery. The membership in a recent year was about 17,500 and included prominent

surgeons of the United States, Canada, and the Latin-American countries.

The organization holds periodic meetings, so-called congresses. The official journal of the college is *Surgery, Gynecology and Obstetrics*.

**SURGEONS, ROYAL COLLEGE OF**, an organization of British physicians which originated as a community in 1460, was incorporated in 1800 as "of London", and became by the charter of 1843 that "of England". The degrees of member (M.R.C.S.) and fellow (F.R.C.S.) are conferred. There is a similar incorporation in Ireland and one in Edinburgh, Scotland.

**SURGERY**, treatment of disease and the correction of deformity or defect by manual and operative procedures, with or without the use of drugs. This branch of medical science is subdivided as follows. (1) According to the nature of the procedure employed, into general surgery, which deals with all manner of cases; orthopedic surgery, which pertains to the correction of deformity; plastic surgery which involves the building up of tissues and the restoration of lost parts, principally by the transfer of tissue. (2) According to the region involved as intracranial or brain surgery, rural or eye surgery; and abdominal or visceral surgery. Many factors have contributed to the development of surgery. Among these may be mentioned the gradual accumulation of knowledge concerning anatomy and physiology, the discovery of the circulation of the blood; the perfection of the microscope; and the invention and manufacture of better instruments and apparatus. The discovery of anesthesia and antisepsis has broadened the scope of surgery so that patients formerly treated with plasters and potions are now subjected to surgical intervention.

*Ancient.* The ancient Egyptians are said to have performed operations such as castration, lithotomy (removal of calculi), amputations, and various operations upon the eye. The Hindus were familiar with surgical practices, such as the treatment of fractures and the removal of calculi, and are credited with having originated plastic surgery. The surgery of the early Greeks seems to have been largely that of the battlefield and, like medicine, to have been derived from the ancient Egyptians. In Rome sacerdotal or guild medicine and surgery prevailed until the time of Hippocrates whose studies, practice, and writings embraced surgery as well as medicine. Little definite progress was marked



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**SURGERY.** *Above: Dr. Ephraim McDowell about to perform the first ovariectomy, 1809 (painting by Dean Cornwell)*  
*Right: Operating in modern hospital.*



until the rise of the Alexandrian school (233–30 B.C.), when surgery was placed upon a basis of diagnostic precision and operative daring through the study of human anatomy. Herophilus was the founder of this study.

**Medieval.** Medieval surgery embraced the period from the decadence of the Alexandrian school to the beginning of the 16th century. Cornelius Celsus (25 B.C.–50 A.D.), Claudius Galen (131–201 or 210 A.D.), and Paulus of Aegina (about 625–90 A.D.), virtually shaped the destiny of surgery throughout the Middle Ages. Byzantine and Arabian medicine helped to foster surgery, and during the latter part of this period European countries, with Italy in the forefront, produced many distinguished surgeons. It was during this period that a distinct separation of medicine and surgery began to be noted. In France about the middle of the 13th century a new order of surgeons arose, known as surgeons of the long robe, in contradistinction to the barber surgeons, who were known as sur-

geons of the short robe. A corporation or gild was formed in several countries. In England, in 1461, Edward IV granted a charter to the Corporation of Barber Surgeons, and the charter of the surgeons of London was confirmed by Henry VIII.

**Reconstruction.** The reconstruction period, embracing the 16th, 17th, and 18th centuries, received the benefit of many discoveries in surgical practice. Much credit for the final emancipation belongs to Ambroise Paré (1510–90), often called the father of modern surgery, who was a member of the Corporation of Barber Surgeons. Paré successfully employed the method of ligating arteries in order to control hemorrhage, thus eliminating the old method of searing the bleeding part with the red-hot iron (the actual cautery).

It was during this period that William Harvey (1578-1656) discovered the circulation of the blood. Anton van Leeuwenhoek, the Dutch lensmaker and naturalist (1632-1723), contributed to the evolution of the microscope which made possible the discovery by Sir Robert Hooke (1635-1703) of the cellular structure of plants, and by Marcello Malpighi (1628-94) of the cellular composition of the blood and of other details, thus paving the way for discoveries in such fields as bacteriology and pathology.

The latter part of this period was prolific of able surgeons. To Peyronie (1678-1747), of Montpellier, is given the credit for having finally effected the separation of the surgeons from the barbers in France. Petit, Brashdor, Desault, and others contributed to the advancement of surgery in France. In England the names of such men as William Cheselden, Alexander Munro, Sir Percival Pott, William and John Hunter, and many others were notable. In Germany, Heister; in Austria, Mohnheim; in Italy, Scarpa; and in Spain, Gimbernat, were outstanding.

**Modern.** The era of modern surgery may be said to begin with the 19th century. The first notable event of the 19th century was the performance of ovariectomy in the treatment of ovarian disease by Ephraim McDowell, of Kentucky, in 1809. Nathan Smith, of Massachusetts, also performed ovariectomy in 1821, without knowing of McDowell's work. Valentine Mott, of New York, ligated important blood vessels in the treatment of aneurism; J. Marion Sims, of Alabama and New York, became known as the founder of modern gynecology; Samuel D. Gross, of Philadelphia, was a great surgeon and teacher. In Great Britain Sir Astley Cooper, Sir Charles Bell, and James Syme were outstanding.

With the discovery of anesthesia in 1842-47 the barrier to progress was removed so far as the possibility of the actual operation was concerned. There still remained, however, hospital gangrene, septicemia, pyemia, and tetanus. It was not until Pasteur (1822-95) evolved his germ theory and discovered that fermentation is caused by microorganisms, that surgery reached its full development.

When Sir Joseph Lister, in 1867-68, applied the discoveries of Pasteur to surgery, and formulated his theory concerning sepsis and antiseptics, the last obstacle to progress was removed.

**Progress.** Surgery is now resorted to for the following purposes. (1) Diagnosis (ex-

ploratory laparotomy; intracranial exploration or exploratory craniotomy; excision, under certain circumstances, of tumor or other tissue for microscopic examination, etc.). (2) The correction of deformity or defect. (3) The cure of disease. (4) The amelioration of suffering. (5) The prolongation of life.

**Corrective surgery** is now employed for clubfeet, bowlegs, deformed spines, congenitally dislocated hip joints, harelips, cleft palates, and many other deformities. In the correction of defects caused by accident or disease *plastic surgery* is utilized. Some surgeons have entered the field of *cosmetic surgery*, the purpose of which is to improve upon the work of nature in response to the vanity of the subject, treating such cases as crumpled ears, malformed noses, and other conditions caused by accident or disease.

**Curative.** In the cure of disease surgery is employed in the treatment of sarcoma, tuberculosis, osteomyelitis, and of bone affections. In this field Sir Arbuthnot Lane of London originated the procedure known as bone plating; Dr. John B. Murphy of Chicago has contributed to the technique of arthroplasty, or the plastic surgery of the joints; and Dr. Fred A. Albee and other American surgeons have contributed to the surgery of the spine by their work on bone transplantation and osteoplasty in the treatment of certain affections of the spine. The brain is subjected to inspection and operation. Tumors are removed, abscesses evacuated, blood clots and other obstructions to the vessels cleared, and many other operations performed. The spinal cord, too, is subjected to surgical treatment and is also utilized for purposes of spinal analgesia. The peripheral nervous system, like the brain and spinal cord, is amenable to surgical treatment in the relief of affections of the nerves themselves or in the course of the surgical care of other diseases.

The vascular system including the heart has been brought within the domain of experimental and practical surgery. A large proportion of the practical surgical work upon the heart deals with injuries to this organ, the majority of these being stab or gunshot wounds. The ligation of arteries for the control of hemorrhage has played an important part in surgical practice since Ambroise Paré introduced it in the 16th century. A new use of ligature has given rise to the term "starvation ligature". It is used to cause shrinkage or atrophy of certain organs. The procedure has been applied to

the uterus, ovaries, testes, spleen, thyroid gland, tongue, and other organs.

The history of the surgery of the respiratory system was entirely changed as a result of the researches of Sauerbruch, Willy Meyer, Meltzer, Elsberg, Ricketts, and others who have devised means of operating upon the lungs and other thoracic viscera without collapse of the lungs. This is accomplished by various kinds of apparatus, all designed for maintenance, during operation, of the necessary differential air pressure, by the hypobarometric and the hyperbarometric methods. Well-known apparatus of this type are the Sauerbruch pneumatic cabinet, Meyer's universal differential cabinet, and Meltzer's intratracheal insufflation method.

In surgery of the gastrointestinal tract, ulcers and tumors are excised, injuries are repaired, adhesions resulting from inflammatory processes broken up, and portions of the tract which are distorted as a result of adhesions are restored to normal function. Portions of the stomach and intestine are sometimes removed for ulcer or cancer. Especial attention has been directed to the surgery of the intestine of late years in connection with a condition to which Sir W. Arbuthnot Lane of London has applied the term "chronic intestinal stasis".

The biliary system (liver, gall bladder, and appendages) has called forth radical procedures. An example of this may be noted in the tendency to remove the gall bladder, in the presence of gall-stones, and drain. Hans Kehr of Berlin, among others practiced cholecystectomy.

The genitourinary system (kidneys, bladder, and organs of reproduction) involves many operative procedures. The surgery of the female generative organs (uterus, ovaries, Fallopian tubes, etc.) is a field in which wonderful achievements have been recorded. The present trend in the surgical treatment of these organs is toward conservatism.

A comparatively new phase of surgery is the treatment of conditions resulting from disordered function of the ductless glands and other organs having an internal secretion (endocrine glands). The pineal and pituitary glands (in the brain), the thyroid, parathyroids and thymus glands (in the neck), the pancreas, the suprarenal capsules, the liver, the spleen, the sexual glands (ovaries and testes), and other structures are now classed among the organs of internal secretion. Theodor Kocher of Bern, one of the leaders of the surgical profession, is well

known through his operations on the thyroid gland.

*Ameliorative.* In the amelioration of suffering surgery is often employed where it is no longer hoped to effect a cure, especially in the relief of cancer. Suffering may be relieved by the cutting of nerves that are pressed upon by the tumor masses, by the removal of such portions of the malignant growth as impinge upon other organs, causing pain or impaired function, and by clearing up ulcerating areas and skin grafting. Sometimes very large areas of degeneration may be cleared up, especially with the aid of certain forms of electricity (fulguration, after the method of De Keating-Hart), and the surface covered with other portions of the patient's body.

Many and important advances have been made in every branch of surgery in the past decade.

Introduction of the sulfonamides (see SULFA DRUGS) has proved invaluable in combating infections such as pyogenic osteomyelitis, otitis media, meningitis, gonorrhea, lymphogranuloma venereum, and post-partum and wound infections.

Prefrontal lobotomy, i.e., section of the four quadrants of the frontal lobes of the brain, has been effective in relieving the pain and anxiety of involutional depression, obsessive tension states, and schizophrenia. The electroencephalograph has been of great value in diagnosis of cerebral conditions and the electrocautery in brain surgery. Irradiation has been effectively employed in lymphomatoid disease and in tumors of the urinary tract. Early diagnosis and surgical removal, or when inoperable, exposure to radium or X rays, has materially reduced mortality and prolonged life in cancer (q.v.).

Surgical ligation of patent ductus arteriosus has proved valuable in selected cases, as has pericardectomy in constrictive pericarditis. When hypertension is caused by diseased kidney, removal of the affected kidney has relieved the condition. A new drug, heparin, has proved valuable in vascular surgery and cerebral thrombosis. Omentopexy, i.e., the operation of sewing the omentum to the abdominal wall, thereby obtaining communication between the portal system and the vena cava, has proved of signal value in relieving the heart in certain disorders.

Removal of the spleen has been successful in treating congestive splenomegaly and a certain type of jaundice (spherocytic). A new technique for observing the condition

of the stomach wall (gastroscopy) has advanced diagnosis and treatment of gastric disorders, including cancer. Marked advances have also been made in surgery of the descending colon and in rectal surgery.

There have been great advances in surgery of the prostate gland, including endoscopic prostatic resection. Stilbesterol and testosterone have been most effective in tumors of the prostate, as has castration.

A new operation has proved beneficial in a certain type of deafness (otosclerotic).

Among new methods of treating burns, sulfadiazine, surgical compression dressings, 5 percent tannic acid, gentian violet jelly, triple dye (aq. sol. ext. violet 1 in 400; brilliant green 1 in 400; flayine 1 in 1000), and saline baths, all have their advocates. It is now recognized that in treating severe or generalized burns, the treatment of shock and toxemia are even more important than local measures.

Plastic surgery, long-neglected special field of surgery, in May, 1941, was granted the status of a major specialty by the Advisory Board of Medical Specialties (U.S.A.). This recognition is based upon the special problems and techniques of this field and upon significant advances in both civil and military practice in this specialty, particularly in methods of skin graft, tissue transplantation, and preservation or restoration of configuration in facial injuries or deformation. In the treatment of facial injuries, esthetic considerations are only secondary to functional. Thus, the extensive excision of wound tracks, the use of the closed plaster method in bone injuries, the tannic acid and silver nitrate treatment of burns, all recognized methods for surgery of other parts, are unsuitable in facial injuries.

The means and methods of surgical anesthesia (q.v.) have been greatly improved, including spinal anesthesia (q.v.), but the latter has proved inadvisable in patients who are in a condition of shock. Preoperative care and preparation of patients has made significant advances with corresponding lowering of mortality rates. Thoracic surgery has been revolutionized by new techniques and thus lobectomy, i.e., excision of a diseased or injured lobe of the lung, has become successful.

**SURGERY, MILITARY**, the specialized application of the principles of traumatic surgery, under military conditions, to wounds of war. In its wider connotation it includes the collection and transportation of wounded,

the administration and control of mobile and stationary hospitals, hospital trains, and ships, submarine and aviation medicine, and the command of sanitary troops.

The science of military surgery began in the 12th century with the secularization of medical practice. The first study of hospital gangrene was made by Paracelsus in the 16th century, in which period also Ambroise Paré introduced the ligature to control hemorrhage.

The tourniquet introduced by Fabriz von Hilden (1560-1634) was first used at the siege of Besançon in 1674. In England in the 17th century Richard Wriesman advocated immediate amputation in cases of severe gunshot wound, a practice that continued through the Peninsular, Crimean, and the Civil wars. In 1714 in Berlin and in 1785 in Vienna schools for the teaching of military surgery were founded and have continued to the present day. In the last decade of the 18th century, with the approval of Napoleon, Baron Larrey introduced mobile field hospitals (*ambulances volantes*) for the treatment of wounds on the battlefield; his colleague, Baron Percy, organized companies of stretcher bearers. The development of the field-ambulance system to its modern form we owe to Surgeon Jonathan Letterman, U.S.A., in the Civil War.

Modern military surgery dates from Civil War times when Lister established the microbic cause of wound infection, which led to the application of an antiseptic first dressing.

Military surgery is concerned with three cardinal conditions: (a) frequency and forms of battlefield casualties; (b) arms and missiles as related to wounds; and (c) care of wounds and the wounded.

One of the new factors in modern warfare was the greater proportion of wounded as against killed (4 to 1) leading to greater numbers requiring treatment. The introduction of the military rifle and machine gun, firing a long, small-caliber, jacketed bullet at greatly increased velocity, changed the nature of small-arm wounds almost as much as Listerism modified the principles of treatment. In this case the wounds depend on the range of fire, the shorter the range the greater the explosive power, with ricocheting bullets offering a dangerous variety. Dumdum bullets, taking their name from a British arsenal near Calcutta where they originated, tear wounds greatly, because they mushroom, flatten, and break up on





U S Army Photo by U S Army Photo

#### MILITARY SURGERY

*Above Doctor and assistants performing an operation on a wounded soldier at the 80th Field Hospital on Luzon Island during World War II Right Army doctors cleaning their hands and arms in preparation for an emergency operation, Australia, 1942*

impact, producing wounds like those of the explosive bullet. All nations signatory to the second Hague convention, excepting the United States and Great Britain, renounced the use of dum-dum and explosive bullets.

Artillery wounds are inflicted by two classes of projectiles—shrapnel and shell. Shrapnel wounds are like those of the old round, leaden musket balls. Because of their low velocity they are more frequently lodged in wounds than are rifle bullets. Shell wounds as a class are much less frequent but far more severe than shrapnel wounds. Shell fragments cause complete destruction near the bursting point, but effect less damage in more distant zones. Wounds by bayonet, saber and lance occur so infrequently as to be of minor interest. Wounds caused by grenades thrown by hand, rifle, and trench mortar differ in no material particular from those of shell fragments and subterranean mines.

Among the new weapons of warfare introduced in World War I were poisonous or asphyxiating gases, among those chiefly



employed being chlorine, chloropicrin, mustard gas, phosgene, and diphosgene. The effects produced were ocular, respiratory, and gastric irritation, and general toxic action. See **CHEMICAL WARFARE**.

For the prevention of wound infection Sir Almroth Wright presented a new method of wound irrigation using the so-called Carrel-Dakin solution, consisting of a little less

than one half of one percent of sodium hypochlorite in water. The solution acts in part by liberating nascent chlorine from the hypochlorite and has the not less valuable secondary action of dissolving pus and necrotic tissue.

In the case of tetanus as a possible complication of wounds no special technique was required, for every wounded man received injection of tetanus antitoxin.

The plastic restorative surgery of the face so much practiced in and after the war although extensive and daring, involved no new surgical principles, and this is also true of the surgery and prosthesis practiced on war cripples. Shell shock was but one of a large number of neurological affections or war neuroses, others including neurasthenia, hysteria, epilepsy, insanity, paralysis, speech disorders, disorders of vision and hearing, and soldier's heart. Shell shock was the result of the explosion of powerful shells—so-called air concussion which caused no visible wound. The gases liberated were also toxic, so that in these victims there was a component of gas poisoning.

The character of warfare introduced in World War II differs radically from prior wars in the extensive use of aerial bombs which break into innumerable fragments producing multiple wounds. These fragments travel at tremendous velocity with devastating effect on body tissues. Wounds from these bomb fragments are frequently associated with crushing or cutting, wounds from falling masonry, glass, or other secondary missiles. These bomb wounds may have on the surface the appearance of trifling wounds while beneath the skin extensive destruction has occurred as a result of the momentum of high velocity fragments in the soft tissues. Wounds are usually multiple. Careful preliminary examination is necessary to discover all wounds and to determine extent of damage in each wound. Even slight protection from shell fragments lessens the severity of these wounds by reducing the high velocity of these missiles.

Marine or terrestrial mines, much used in World War II, may in addition to direct tissue injury from fragments, produce serious damage to internal organs or tissues without external wound. Flame projectors which contain gasoline or other oils, in exploding produce terrible wounds. Fragments of high explosives, owing to their ragged conformation, inflict more damage than bullets or shrapnel and usually carry into the tissues

fragments of clothing carrying infective agents.

Modern war wounds are therefore characterized by multiplicity, hidden destruction, tissue disruption, great loss of blood, virulent infection, grave shock, general concussion, and demoralization.

To meet these devastating destructive agencies, military surgery has developed more potent remedies and better techniques.

Great contributions of World War II include the sulfa drugs (q.v.) to prevent infection, and blood banks and plasma (see TRANSFUSION OF BLOOD) reserves to combat shock and loss of blood and tissue fluids. Wounds are treated by excision of all tissues lining wound track, control of hemorrhage, prophylactic use of sulfonamides, immobilization of wounded part, rest, and treatment of shock and loss of blood. H. Winnett Orr, American surgeon in World War I, advocated the closed plaster method, which was used successfully by Trueta in the Spanish Civil War. This requires complete wound excision within eight hours of injury, adequate blood supply, wound cavity packed with gauze and then encased in plaster of Paris. Wound excision must never be done after eighteen hours from injury. In delayed treatment, free drainage and irrigation with Carrel-Dakin solution is used.

Shock is treated by morphine, heat, rest, plasma transfusions, administration of oxygen, and adrenal cortex. At least ten percent of wounded require blood or plasma transfusions for hemorrhage or shock.

Burns must be treated with a view to shock, toxemia, and scarring. Extensive burns such as received by crews immersed in oil-inflamed seas are relieved by warm saline baths.

To avoid tetanus (lockjaw), all military personnel are immunized by tetanus toxoid. In addition, every casualty is given tetanus antitoxin. As a result the British have reduced incidence of tetanus to 0.05 per 1000 as against 8 per 1000 in World War I.

In many wars, surgeons, including Baron Larreys, have noted that maggot-infested wounds were clean. It remained for W.S. Baer, American surgeon, to employ sterilized maggots to clean up wounds already infected when first seen by the surgeon. The maggots rapidly remove dead tissues and stimulate growth of new tissues in these rotten wounds.

Other improvements in military surgery include improved frames and splints for broken limbs (Thomas and Braun) and co-operation between surgeons and makers of



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IN SURINAM SOUTH AMERICA

*Above: Native transport canoes on Surinam River near Mamadam (right: Ojuna Indian)*

artificial limbs (qv) and appliances for rehabilitation of the crippled. See SURGERY.

**SURGICAL ASSOCIATION, AMERICAN**, an organization founded (1880) for the promotion of the science of surgery. It holds annual meetings in various centers. Membership in a recent year was about 350.

**SURICATE**, or MELRKAT, a small, furry, diurnal vegetable eating, and burrowing civet, *Suricata tetradactyla* of South Africa allied to the mongooses. It is gregarious and a colony makes burrows close together, like a prairie dog "town."

**SURIGAO**, capital of the province of the same name, Mindanao I., Republic of the Philippines, situated in the extreme NE part of the island. Agriculture, forestry, and mining are the principal industries of the province. Area of province, 3079 sq m. pop. about 226,000. Pop. of municipality about 34,000.

**SURINAM** (Du *Swiname*), sometimes NETHERLANDS, or DUTCH, GUIANA, overseas territory of the Netherlands, forming an autonomous part of the kingdom, situated in South America, and bounded on the N by the Atlantic Ocean, on the E by French Guiana, on the S by Brazil, and on the W by British Gui



ana. Physiographically, Surinam consists of a swampy coastal plain, ranging up to 100 m. in width; a central plateau region containing broad savannas, tracts of dunes, and forested areas; and, to the s., a densely forested, mountainous region which is largely unexplored. There are numerous rivers, notably the Maroni, delineating most of the French Guiana border, the Courantyne, delineating the British Guiana border, and the Coppename, Saramacca, and Suriname.

Agriculture, confined mainly to the plains area and the river valleys, is the principal industry. Rice is the chief crop. Other leading crops are oranges, sugar cane, coffee, bananas, grapefruit, and coconuts. Additional industries include lumbering, the manufacture of molasses and rum, and mining. Bauxite and gold are the leading mineral products. Among important exports are bauxite, rice, citrus fruits, coconuts, timber, and balata.

For administrative purposes Surinam is divided into seven districts. By the terms of the constitution of 1950 executive power is vested in a governor, an appointee of the crown, who is assisted by a ministry and an advisory council. Members of both bodies are appointed by the governor, but the ministry is responsible to the legislative council, which exercises legislative authority. This body, consisting of twenty-one members, is elected every four years by the people. Paramaribo (q.v.) is the capital, largest community, and chief seaport.

Negroes, British East Indians, and Javanese comprise a large majority of the population. *Boschnegers* (Du., "Bush Negroes") and aboriginal Indians (about 22,000 and 3700 respectively) inhabit the forested areas.

**History.** English traders began to colonize the region comprising modern Surinam during the first half of the 17th century. In 1667 the region was ceded to the Netherlands in exchange for New Amsterdam (later New York City). Great Britain invaded and held Surinam during two periods, 1799–1802 and 1804–16, and finally confirmed Dutch possession by treaties following the Napoleonic Wars. According to a revision of the Dutch constitution in 1922, Surinam was made an integral part of the Netherlands Kingdom. Area, 55,143 sq.m.; pop. (1951 est.) 223,000, including Djukas and aboriginal Indians.

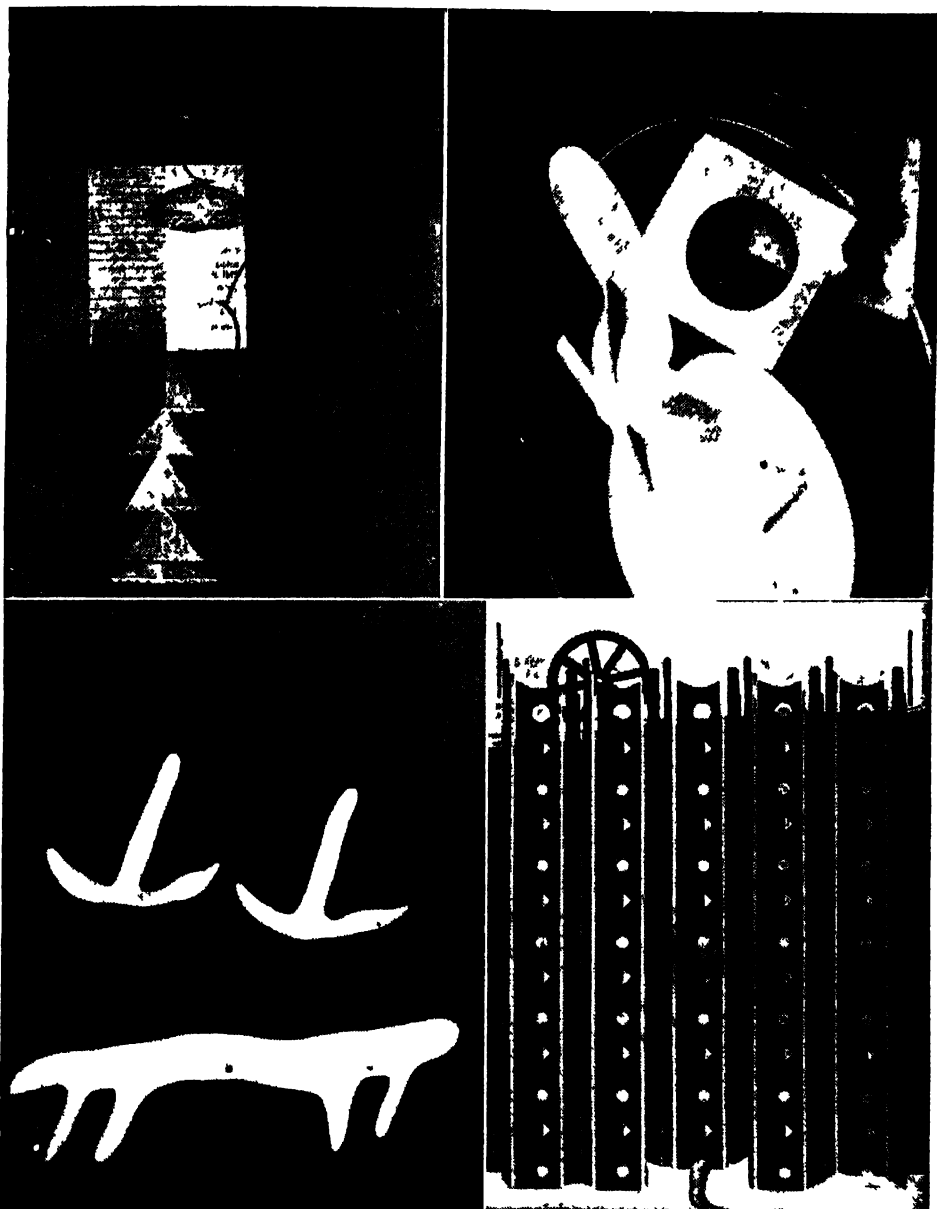
**SURMULLET**, one of certain species of mullets found for the most part in the tropical seas. The striped red surmullet, *Mullus surmuletus*, attaining a weight of six to eight pounds, is sometimes abundant on the coasts

of Europe. A similar species, *Mullus auratus*, about 8 inches long, occurs along the Atlantic coast of North America, particularly toward the south.

**SURPLICE**, white linen garment worn in the Roman Catholic Church by all ecclesiastics in choir except the officiants of the mass, and by the clergy of the Anglican communion; also, in both churches, by laymen and boys who sing in the choir or assist at the altar. See **COSTUME**, **ECCLESIASTICAL**.

**SURRATT**, MARY E. (1820–65), American woman who became involved in the conspiracy against the life of Abraham Lincoln. She was born near Waterloo, Prince George Co., Md., and about 1835 married John H. Surratt. In 1862 Mrs. Surratt went to Washington and opened the boarding house which became the meeting place of the men who plotted to kill President Lincoln and other members of the government. After Lincoln's death Mrs. Surratt was arrested and, with three of Booth's accomplices (see **BOOTH**, **JOHN WILKES**), was tried and convicted by a military commission appointed by President Andrew Johnson. The sentence of death by hanging was carried out at Washington on July 9, 1865. During the trial doubts as to Mrs. Surratt's guilt were expressed, and a long controversy in the press followed, the weight of opinion inclining in her favor. It was said that a majority of the members of the military commission had signed a petition for clemency to President Johnson and that this petition was withheld from his knowledge, but this was vigorously denied.

**SURREALISM**, a French movement in literature and the graphic arts founded in Paris, about 1923, by the poet André Breton. It grew directly out of the movement known as dadaism (q.v.), and, like dadaism, emphasized the role of the unconscious (q.v.) in creative activity, but employed the psychic unconscious in a more orderly and more serious manner. The surrealists claimed as their literary forefathers a long line of writers, outstanding among whom is the Comte de Lautréamont, author of the lengthy and complicated work, *Chants de Maldoror* (1868–70). Many of the most distinguished French writers of the early 20th century were at one time connected with the movement, including, beside Breton, Paul Éluard, (1895– ), Louis Aragon, and Philippe Soupault (1897– ). The pure surrealist writer used "automatism" as a literary form, that is, he sat down before his paper, wrote



Collection Museum of Modern Art, New York

**SURREALISM** Top, left "Street Singer," by André Masson. Top, right "Rayograph," by Man Ray Bottom, left "Mountain, Table, Anchors, Na' " by Hans Arp Bottom, right: "The Little Tear Gland That Says Tic Tac," by Max Ernst.

whatever words came into his conscious mind, and regarded these words as inviolable. He did not alter what he wrote, as that would constitute an interference with the pure act of creation. A typical short example of sur-

realist writing is the "proverb" by Paul Éluard which states "Elephants are contagious". Like their forerunners, the dadaists, the surrealists aimed at shocking society by breaking accepted rules of work and personal



French Film Information

MEMBERS OF THE SURREALIST MOVEMENT Top, left Paul Eluard Top, right Louis Aragon Bottom Andre Breton looking at one of the surrealist objects at an art exhibit

conduct The movement spread all over the world, and flourished in America during World War II when Andre Breton was living in New York City

In painting and sculpture surrealism was one of the leading influences of the 20th

century It claimed as its ancestors in the graphic arts such painters as the English William Blake and the French Odilon Redon (1840-1916), and in this century also admired, and included in its exhibitions, works by Giorgio di Chirico, Paul Klee, Marcel

Duchamp (1887— ), and Pablo Picasso, none of whom was ever a member of the surrealist group. From 1923 Max Ernst (1891— ), Jean Arp (1888— ), and the American painter and photographer Man Ray (1890— ) were members. They were joined for a short time about 1925 by André Masson (1896— ), and Joan Miró, who remained members for some time, but were too individualistic as painters to submit to the strong leadership of André Breton, who exercised final authority over the movement. Later members of the surrealist group included Yves Tanguy, René Magritte (1898— ), and Alberto Giacometti. The Catalan painter Salvador Dalí joined the movement in 1930, but was later denounced by most surrealists because he was held to be more interested in commercializing his art than in surrealist ideas. Surrealist painting exhibits great variety of content and technique. That of Dalí for example, consists of more or less a direct and photographic transcriptions of dreams, deriving its inspiration from the earlier dream paintings of the Italian (Chirico). Arp's sculptures are large, smooth, abstract forms, and Joan Miró a formal member of the group for a short time only, employed, as a rule, fantastic shapes which had something in common with the designs used by the native Catalan artists to decorate pottery. A representative collection of the graphic works of the surrealists is in the Museum of Modern Art, New York City.

For further information, see articles on all men whose names are not followed by birth and death dates.

**SURREY**, an inland county in the s. of England, s. of the Thames. The surface is hilly and diversified, with a north slope toward the Thames. The principal streams are the Mole and Wey, tributaries of the Thames. The north half of the county along the valley of the Thames is fertile, though little over half of the land in the county is cultivated, hops, wheat, and the ordinary crops being raised; market gardening constitutes a lucrative industry. In the west and southwest the land is to a great extent covered with heath. The numerous manufactures include silk, cloth, leather, paper, pottery, and beer. Area, 722 sq.m.; pop. (1951 prelim.) 1,601,555.

**SURREY, HENRY HOWARD, EARL OF** (about 1517-47), English soldier and poet, son of Lord Thomas Howard. His youth was spent in France and at the court of Henry VIII, and he received a careful classical education.

He was made knight of the garter in 1541 and in 1543 joined the English army in France, where by his prowess he gained the title of field marshal. He captured Boulogne, was made its governor, and gained other victories, but was recalled to England after slight reverses at Saint-Étienne. His influence at court was no longer so powerful as in the life of his youthful friend and companion the Duke of Richmond, Henry's natural son, and charges of treasonable ambition were constantly urged against Surrey by a court faction. In 1546 he was arrested, and, on trivial charges, was beheaded the following year. Though not primarily a man of letters, Surrey's work in that field left a more abiding impression than his soldiery. He wrote amatory verses and elegies, but his service to English literature lay in the insight with which he enriched its poetry by the introduction of new verse forms. His translation of two books of the *Æneid* by the ancient Roman poet Vergil gave the English language its most powerful and characteristic poetic form, blank verse, and the sonnet which Shakespeare used, consisting of three quatrains and a couplet, was also introduced by Surrey.

**SURROGATE.** See SURROGATE'S COURT.

**SURROGATE'S COURT**, in the judicial system of the United States, a court having jurisdiction primarily over matters relating to the administration of the estates of decedents. The judicial officer of the court is known as a surrogate. In some States of the U.S. such a court is known as a probate court or an orphan's court. In many States the appointment of guardians of the person and property of infants and jurisdiction over adoption proceedings is lodged with the surrogate. A decedent may have disposed of his property by will (q.v.) or may have died without making any disposition of his property (see *INTESTACY*). If he has left a will, proceeding to probate the will is commenced by the filing of a petition, an instrument corresponding to a complaint in a civil action. Probate consists of establishing to the satisfaction of the court the proper execution of the will and the capacity of the decedent to dispose of his estate. The petition for probate states the time and place of decedent's death, and gives the names and addresses of all persons who might be interested in the estate as heirs, next of kin, legatees, or executors; a copy of the will is incorporated with the petition. Objections to probate of the will, if any, are tried by

the surrogate. After the will is admitted to probate it is recorded in the court, and certificates known as letters testamentary are issued to the executor (q.v.) as evidence of his authority to act. If a decedent is intestate, a petition is filed by any of the decedent's next of kin, who may apply for the appointment of an administrator (q.v.) of the estate. Letters of administration are issued by the court to the administrator appointed.

The executor or administrator then pays decedent's debts and disposes of the balance of decedent's assets as directed by the will or under the intestacy laws. The court in which proceedings are originally instituted is the Surrogate's Court of the county or district in which the decedent was domiciled at the time of his death, even though the deceased had no assets in that district or in the State. If the decedent has assets in any State other than the State in which he had established a domicile prior to his death, proceedings known as ancillary administration must be taken in the Surrogate's Courts of such other State.

In England the power to grant probate of wills or letters of administration upon estates of persons dying intestate is given to officials, known as registrars, in each registry district. In litigation to probate on the ground of insanity of the decedent at the time the will was executed, however, the probate proceedings must be taken in the proper county court or in the Probate Division of the Supreme Court of Judicature.

**SURTEES, ROBERT** (1779-1834), English antiquary, born in Durham. He devoted much of his life to his exhaustive *History of Durham*. He was an adept at the composition of "ancient" ballads. As a memorial to him the Surtees Society was established in Durham in 1834 for the publication of unedited manuscripts bearing on the history of the northern counties of England from the earliest period to the Restoration.

**SURTEES, ROBERT SMITH** (1803-64), English sporting novelist, born in Durham, and educated for the law. In 1832 he helped to found, and for five years he edited, the *New Sporting Magazine*, to which he contributed (1832-34) humorous papers chronicling the sporting experiences of a cockney grocer. Collected as *Jorrock's Jaunts and Jollities* (1838) and illustrated by "Phiz", these sketches had an immense vogue. This volume suggested the original plan of *Pickwick Papers*.

**SURVEYING**, the art of ascertaining by measurement the shape and size of any portion of the earth's surface and representing the same on a reduced scale on maps in a conventional manner, or the reproduction on the ground of a predetermined line or lines, as for the construction of a canal, railway, bridge, or other structure for which plans have been drawn. According to Herodotus the science of surveying originated in Egypt. The first treatise on surveying extant is that of Hero of Alexandria (about 130 A.C.).

Surveys are broadly separated into two classes, determined by the extent of the area surveyed or the purpose for which the survey is made. *Plane* surveying ordinarily includes, besides land surveying, topographic surveying, hydrographic surveying, mine surveying, city surveying, and the measurement of earthwork or volumes of any material. *Geological* surveying is a development of topographic surveying in which the outcrops of the earth's rock formation are located and denoted on topographic maps. *Geodetic* surveying is a class by itself, as is also photographic (or aerial) surveying.

A *cadastral* survey takes note of the extent, value, and ownership of landed property as a basis of taxation.

**Land Surveying.** Land surveys are made (1) to establish certain monuments, corners, lines, and boundaries, so as to lay out and divide land; or (2) to identify and locate such monuments, lines, and boundaries after they have been established, as in all resurveys for location and area. The fundamental rule of every kind of land surveying is simply to determine three elements of a triangle, and thence to calculate its area. A datum line is the base line of a section, or profile of the ground, when drawn on paper. It represents a horizontal surface at some arbitrary height above the fixed datum point. On the ground, lines are marked only at regular intervals called stations or at the angles, points, or corners. The corner marks are called monuments and are usually of a permanent character.

For ordinary land surveying but two instruments are required, a chain or tape and an instrument for measuring angles or for determining the difference in direction between two or more intersecting lines. The simplest instrument for this purpose is a square or cross-staff, which gives two horizontal lines of sight at right angles to each other.



The measurement of angles directly in degrees and minutes of circular arc did not come into vogue until about the 16th century. The combination of a magnetic compass with instruments for accurate angular measurement is a comparatively modern invention (about 1830). There are many inaccuracies arising from the use of a magnetic compass, not only from the irregularities of the needle according to the laws of terrestrial magnetism but from local attraction. It is no longer used except for reconnaissance or very rough work, but it is still universal practice to describe land by distances and bearings of courses. The now universal surveying instrument is the transit. (See SURVEYING INSTRUMENTS.) Measuring the lengths and directions or bearings of survey lines is called traversing.

The simplest method of computing area is to divide the survey polygon into triangles. This, however, is cumbersome and requires many additional measurements. The method most used depends upon establishing the corners by a system of rectangular co-ordinates, known as latitudes and departures, which are readily computed by trigonometry from the lengths and bearings of the courses. Mathematical tables for simplifying these computations are called traverse tables.

**Topographic Surveying.** Topographic surveying requires measurements in vertical planes as well as horizontal. Otherwise it does not differ from ordinary land surveying except in instruments and methods. The basis of all topographic surveys is a line or network of lines established by accurate measurements, to which all other details are tied either by rectangular or polar co-ordinates or a combination of both. The simplest topographic survey is that for a railway location. A single survey line or center line is established on the ground by stakes driven at 100-foot intervals. The direction of this line is determined by angular measurements with a transit, starting from a line of known direction. When it has been marked upon the ground by stakes as described, the line is leveled (see LEVEL) and the elevations of the ground at each stake determined. With the notes of the transit and level surveys the topographer follows over the line and locates the contours, or such contours as it is desirable to show, of a belt of country 250 to 500 feet on either side of the center line. Contours are the traces of parallel horizontal planes on the surface of the ground, or what would be the shore line at

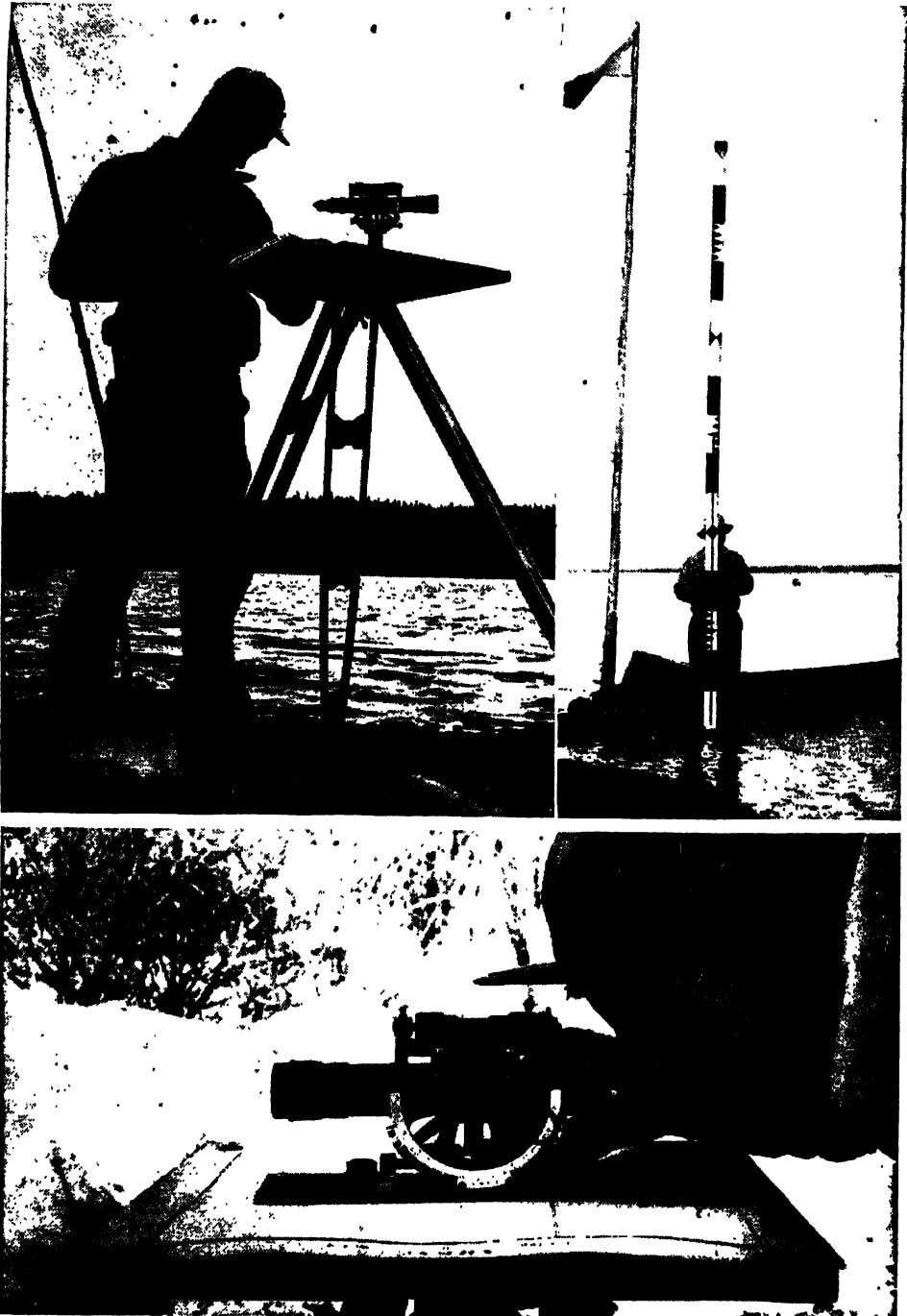


Herbert Lanks, from Black Star

*A surveyor sighting through the telescope of a transit, used for measuring angles*

successive stages if the ground were first submerged and the water allowed to recede in stages of 2, 3, 5, 10, 20, or 50 feet, whichever is chosen as the contour interval. The instruments ordinarily used by the railway topographer are a hand level and a cloth tape. The science of plotting land surfaces, or mapping, is termed cartography.

**Hydrographic Surveying** Hydrographic surveying includes two kinds of work. Charts of the seacoast and the shores of any body of water are intended to show much the same information in regard to the sea bottom that topographic maps show of the surface of the land. In recent years the United States Coast and Geodetic Survey has developed a method of verifying the depths of exten-



Standard Oil Co. (N.J.)

**SURVEYING.** *Top, left: Surveyor, using alidade and plane table, maps a ground point. Top, right: Holding a leveling rod. Bottom: Peering through an alidade on a plane table.*

sive areas or of determining shoals or obstructions in those areas by sweeping over them with long wire drags or sweeps, which consist essentially of a horizontal wire suspended at any desired depth and drawn through the water by small power boats. See HYDROGRAPHY.

The other kind of surveying included under the term "hydrographic" is the measurement of stream flow. There are several methods; the simplest, of course, is to measure the size of the stream bed and the velocity of the flow. Hydrographic surveying also includes studies of rainfall and run off and other allied subjects.

**Mine Surveying.** Mine surveys are of two classes: (1) surveys to determine the surface location and boundaries of mining claims; and (2) underground surveys to determine connections, lay out work, establish the relations of the underground workings to the surface lines, points, and so on, and measure the ore removed or still in the mine. The surface methods employed are substantially land surveying methods as modified by the local and general mining laws. The underground surveys comprise carrying surface locations underground, lining on the galleries and shafts, running levels, etc., and laying out tramways and railroads. This work is ordinarily carried on much the same as it is on the surface. See MINES AND MINING.

**City Surveying.** City surveying is ordinary land surveying in theory, but geodetic or precise surveying in practice. Linear measurements are accurately made with standardized steel or invar tapes, making allowance for the stretch and sag of the tape and its change in length from differences in temperature. Angular measurements are made to seconds of arc by repeating the measurement and averaging the sum of these repetitions. Land in great cities is often worth several thousand dollars a front foot, and errors of a fraction of an inch would be costly.

See AERIAL SURVEY; COAST AND GEODETIC SURVEY.

**SURVEYING INSTRUMENTS,** instruments used by engineer and surveyor in determining elevations, directions, and distances in their work of mapping land and locating and laying out engineering works. They may be divided into instruments for (1) measuring distances, (2) determining directions, (3) determining horizontal lines, (4) measuring angles, and (5) miscellaneous work.

For measuring distances chains, tapes, and

wooden or metallic rods may be used. The chain is of two kinds, the Gunter and the engineer's. The former was invented by Edmund Gunter, an English engineer, in 1620 and is 66 feet long, divided into 100 links, each of which is 7.92 inches long. This chain is now used only in connection with the United States Public Lands or farm surveys, where the unit of area is the acre, and where extreme accuracy is not a required essential.

The engineer's chain is similar to the Gunter chain except that it is 100 feet long and has 100 links each 1 foot long. It too is seldom used except in a rough reconnaissance or in the preliminary location of the center line of a railroad, where the stations or marks are 100 feet apart.

The tape is now universally used, as it is more convenient, less bulky, more accurate, and reads to finer divisions. Tapes vary from the small 3-foot pocket tape to the 1000-foot tape used in mine surveys, and usually are thin ribbons of steel or a nickel-steel alloy with small temperature coefficient known as invar with the feet and subdivisions etched upon them, though there are cloth and metallic tapes which are made of oiled cloth, the latter with threads of metal woven into them to prevent stretching. The usual length is 50 or 100 feet.

In very precise surveying, i.e., in geodetic work, metallic rods or bars called base bars are used to measure the base lines, upon which a system of triangulation is built up for the purpose of accurately locating points and determining distances.

For measuring directions the simplest instrument is the surveyor's compass, but it is now rarely used. This consists essentially of two uprights having vertical slits to give a line of sight, which are attached to a horizontal graduated circle at the center of which is mounted a magnetic needle free to move, the whole being supported with devices for leveling. The use of the needle compass is confined almost entirely to land surveying, when extreme accuracy is not of great importance. The solar compass is a modification of the above, but from an observation on the sun the true meridian and the bearing of a line are determined instead of the magnetic bearing. The prismatic compass is a hand instrument with a glass prism so arranged that the needle is read while taking the sight.

For determining horizontal lines the engineer's level is the instrument most commonly employed. This instrument consists of a

telescope with cross-hoist to determine the line of sight, clamped in Y-shaped uprights rising from a bar and carrying a spirit level and resting on a vertical pivot revolving in a socket in the plate which fastens the instrument to its tripod or other support. A dumpy level has a short telescope with a wide aperture. An architect's level has a compass attachment. The level is used to find the relative elevation of points a considerable distance apart, to obtain the profile of a line, and to establish a grade. See **LEVEL**.

For measuring angles the instrument most commonly used by engineers is the transit. The transit consists of two concentric circular plates of copper, brass, or other material moving round a common axis, which, being double, admits of one plate moving independently of the other. Upon the upper horizontal rise two supports, bearing a horizontal crossbar, which is the axis of a vertical circle. This circle either has a telescope fixed concentric with itself, or a semi-circle is substituted for the circle, and the telescope is laid above and parallel to its diameter. The circles are employed in the measurement of horizontal and vertical angles. The upper horizontal is furnished with two levels placed at right angles to each other for purposes of adjustment and has a compass box let into it at its center. The stand consists of a circular plate supported on three legs and connected with the lower horizontal by means of a ball-and-socket joint, the horizontal adjustment of the instrument being effected by means of three or four upright screws. The telescope is so fixed as to be reversible. Both horizontal plates being made truly level, the telescope is pointed at one object, and the readings off from the graduated circle again performed; by the difference of the readings the angular horizontal deviation is given. When vertical angles are required, the readings are taken from a vertical circle in a similar manner.

An instrument of the same construction, but the telescope of which cannot make a complete revolution on the horizontal axis, and thus does not transit, is usually called a theodolite. Theodolites are commonly made larger and more powerful than transits and are mostly used in important triangulation work, such as that for coast and geodetic surveys. The sextant is a convenient hand instrument for measuring angles universally and for making observations on shipboard, and also frequently used by engineers in

surveying when angles have to be measured from a boat, as in locating soundings and buoys. The plane table is an instrument for making topographic surveys and consists of an ordinary drafting board mounted on a tripod together with an instrument called an alidade. This latter consists of a line of sight, usually telescopic, mounted on a vertical support to which is attached a ruler, the edge of which is parallel to the line of sight.

Among miscellaneous engineers' instruments may be mentioned the aneroid barometer for determining altitudes; the pedometer for recording the number of steps taken by a walking man, which number multiplied by the length of step gives the distance traveled; the odometer, cyclometer, or speedometer, which record the number of revolutions of a wheel, which number, multiplied by the circumference of the wheel, gives the distance traveled; the clinometer, a device for measuring the dip of a vein, etc.; the planimeter, a device for measuring irregular areas which have been mapped to scale; the pantograph, for reproducing to the same or different scales from maps drawn on paper; and various drawing instruments, used in making maps and scale drawings of structures and machines. The heliotrope is an instrument used in geodetic surveying for the purpose of locating for the observer the station he wishes to observe, and at the same time it acts as the object to be sighted. It consists of one or more mirrors so arranged as to reflect a ray of light to the observer. See **COAST AND GEODETIC SURVEYING**; **SURVEYING**. For the use of the camera in surveying, see **AERIAL SURVEY**.

**SURYASIDDHANTA** (Skr., "textbook of the sun"), the earliest Hindu astronomy that has been preserved. It was composed after about 300 A.D., and was one of four treatises written in verse and containing 14 chapters. For the adherents of the Hindu science of astronomy it remains the chief authority in India, along with the work of Brahmagupta (q.v.). It is probable that Greek astronomy exercised some influence over this as over later Hindu works on this science. The *Suryasiddhanta* has been published repeatedly in India, the best editions being those by Hall and Deva Sastri (Calcutta, 1859) and Dvivedi (1911).

**SUSA**, a capital and royal residence of the ancient Persian province of Susiana or Elam (q.v.), and later of Persia. It was once an important city of the East. Mentioned in



British Information Services

*Britons on the beach at Brighton, a famous beach resort in Sussex*

inscriptions as having been captured and brought under Persian rule by Cyrus it declined with the fall of Babylon Excavations have brought to light a colossal colonnade the great palace of Darius Hyastaspis inscriptions colored tiles and the reputed tomb of Daniel Susanna is identical with the Shushan of Biblical narratives and approximates the modern province of Khuzistan

**SUSANNA, HISTORY OF**, also known as THE JUDGMENT OF DANIEL and as SUSANNA AND THE ELDERS one of three deuteronomic additions to the Book of Daniel in the Greek Bible the others being The Song of the Three Holy Children and The History of Bel and the Dragon It was probably written originally in Aramaic or Hebrew about 130 BC In most manuscripts it precedes the first chapter of the Book of Daniel but the Septuagint the Vulgate the Polyglot and the Hexapla Syniac place it at the end of the book and reckon it as the thirteenth chapter

**SUSIANA**. See KHUZISTAN, SUSA

**SUSO** or **SEUSE**, HILINRICH (about 1295-1366), German mystic, born in Ueberlingen, Baden At the age of thirteen he entered the Dominican Order and spent most of his life in monasteries at Constance and Ulm He was impulsive and an enthusiastic disciple of the German mystic Johannes Eckhart (qv), but gave that master's speculative ideas a spiritual expression He was truly called "the sweet" Suso on account of his poetry and childlike religion Suso's *Auto*

*lyric* *lyric* and his *Book of Everlasting Wisdom* have been translated into many languages and are both of unique importance for the study of the psychology of mysticism He died at Ulm and was beatified by Pope Gregory XVI in 1811

**SUSPENSION**, the prolongation of any note or a chord into the succeeding chord causing it first a dissonance which disappears by resolution See HARMONY

**SUSQUEHANNA**, a borough of Susquehanna Co Pa situated on the Susquehanna River about 15 miles from the NE corner of the State It is surrounded by an agricultural area in which cattle berries and potatoes are the principal products The region also contains 1 mines and stone quarries Industrial establishments in the borough include machine shops and railroad shops and yards Pop (1950) 2646

**SUSQUEHANNA RIVER**, a river draining the greater part of Pennsylvania It rises in Otsego Lake New York and flows southward across Pennsylvania and into Maryland where it empties into Chesapeake Bay after a total course of about 300 miles It is almost throughout a shallow, swift, and unnavigable stream but its entire course is through some very populous industrial and mining regions It receives its chief tributaries from the west, the Chemung, which joins it near the New York boundary, the large West Branch, 200 miles long, and the Juniata

**SUSSEX**, county of England, situated in the SE part of Great Britain along the Eng

lish Channel, and consisting of the administrative counties of East Sussex and West Sussex. The dominant feature of the county terrain is the South Downs, a coastal range of low chalk hills terminating at Beachy Head (q.v.), in East Sussex. Beyond the South Downs is a fertile, wooded, generally level plains region known as the Weald. The principal rivers are the Ouse, Adur, Rother, and Arun. Sheep raising, dairying, farming, fishing, and catering to the tourist trade are the chief occupations. Among the leading crops are wheat, oats, hops, sugar beets, and fruit. Lewes is the county town of East Sussex; Chichester is the county town of West Sussex. Brighton, Bexhill, Eastbourne, and Arundel are other important communities. Area of East Sussex, 829 sq.m.; pop. (1951 est.) 618,083. Area of West Sussex, 628 sq.m.; pop. (1951 est.) 313,661.

**SUSSEX CATTLE**, a breed of beef cattle which originated in the county of Sussex, England, in ancient times. Characteristics of this breed are great weight, aptitude to fatten, and red color. Originally they were used chiefly for draft purposes, but even in remote times the quality of their flesh was highly prized and when the oxen became aged they were grazed a year and then slaughtered for the market. Because of their tendency to fatten readily and economically, the breed has been popular with tenant farmers. While the Sussex breed is found to some extent in the United States, they are not as widely distributed in America as some other breeds.

**SUSSEX SPANIEL**, a breed of spaniel developed in the early part of the 19th century in Sussex, England. The dog has keen powers of scent, but is not as speedy as the Cocker spaniel and the English and Welsh springer spaniels; it is valuable chiefly as an aid in hunting through heavy cover; when properly trained it makes a good retriever. The dog has a moderately long and wide skull, soft hazel eyes; moderately thick ears, which are set fairly low; a short neck; short legs; a long body; and a tail that is usually docked so that it is from 5 to 7 inches long. The coat of the Sussex spaniel is flat or somewhat waved and in color is a rich golden liver. The dog weighs between 35 and 45 pounds.

**SUSSEX ULTIMATUM**, an official statement issued by the United States government to Germany, the evasion and practical rejection of which was a contributing cause of the entry of the United States into World War I on the side of the Allies.

The *Sussex*, an English Channel steamer, plied regularly between Folkestone and Dieppe. On March 24, 1916, it was attacked by a German submarine, eighty of the persons on board being killed or wounded, two of those injured being Americans. As a result of this and previous incidents of a similar nature, including the sinking of the *Lusitania* on May 7, 1915, the secretary of state of the United States, Robert Lansing, delivered the famous "Sussex Ultimatum" to the German government (April 18, 1916), reading in part as follows:

"If it is still the purpose of the Imperial Government to prosecute relentless and indiscriminate warfare against vessels of commerce by the use of submarines without regard to what the Government of the United States must consider the sacred and indisputable rules of international law and the universally recognized dictates of humanity, the Government of the United States is at last forced to the conclusion that there is but one course it can pursue. Unless the Imperial Government should now immediately declare and effect an abandonment of its present methods of submarine warfare against passenger and freight carrying vessels, the Government of the United States can have no choice but to sever diplomatic relations with the German Empire altogether. This action the Government of the United States contemplates with the greatest reluctance but feels constrained to take in behalf of humanity and the rights of neutral nations."

The German Government replied (May 4, 1916) by offering assurance that, henceforth, merchant vessels would not be sunk without warning and without saving lives, unless they attempted to escape or offered resistance. This pledge, however, was qualified by a condition that the United States should demand and insist that the British Government observe universally recognized rules of international law. Secretary Lansing in a note dated May 8, 1916, replied: "In order . . . to avoid any possible misunderstanding, the Government of the United States notifies the Imperial Government that it can not for a moment entertain, much less discuss, a suggestion that respect by German naval forces for the rights of citizens of the United States upon the high seas should in any way or in the slightest degree be made contingent upon the conduct of any other Government affecting the rights of neutrals and non-combatants. Responsibility in such matters

is single, not joint; absolute, not relative." No reply was made to this note by the German government.

**SUTHERLAND**, a maritime county of northern Scotland. The total cultivated area is small, in spite of costly reclamations. Deer forests, grouse moors, and fishing attract many sportsmen. Area, 2028 sq.m; pop (1951 prelim.) 13,664.

**SUTHERLAND**, ALEXANDER (1833-1910), Canadian Methodist clergyman, born in Wellington County, Ontario, and educated at Victoria College, Cobourg. He was ordained to the Wesleyan Methodist ministry in 1859. Subsequently he was pastor of important churches in Hamilton, Toronto, and Montreal. He was elected missionary secretary of his church in 1874 and displayed remarkable zeal and eloquence as well as business ability in expanding and consolidating the missionary interests committed to his charge. An active worker in the temperance cause, Sutherland was made president of the Prohibition Third Party in Ontario. He took a foremost part in the work of uniting the Wesleyan Methodist, Methodist Episcopal, Bible Christian, New Connexion, and Primitive Methodist denominations into one Methodist Church in 1883.

**SUTHERLAND**, GEORGE (1863-1942), American jurist and legislator, born in Stony Stratford, Buckinghamshire, England. His parents brought him to the United States in 1864 and settled in Utah. He graduated from Brigham Young University in 1881 and from the University of Michigan in 1883. After 1893 he practiced law in Salt Lake City. He was a member of the Utah senate (1896-1900), a representative in Congress (1901-03), and United States senator (1905-17). He was associate justice of the U.S. Supreme Court (1922-38). He is the author of *Constitutional Power and World Affairs* (1919).

**SUTLEJ**, or **SATLEJ**, the chief tributary of the Indus. It rises in Tibet and flows southwest through the great arid plains of the Punjab, joining the Indus after a course of about 950 miles. The Sutlej is the eastern and southernmost of the Five Rivers of the Punjab, the other four being its two main tributaries, the Beas and the Chenab, together with two branches of the latter. Below the confluence of the Beas the river is sometimes called the Ghara, and its lowest course, after receiving the Chenab, is called the Panjnad, or Five Rivers.

**SUTRO**, ADOLPH HEINRICH JOSEPH (1830-98), American mining engineer, born in Aachen, Rhenish Prussia. He came to the United States in 1850, made his way to California, and, as he had studied mining in Prussia, his technical knowledge proved of great use. Visiting Nevada (1860), he projected the Sutro tunnel to tap the Comstock lode. The enterprise, completed in 1879, made its projector a millionaire. He was elected mayor of San Francisco in 1894 and made numerous gifts to the city.

**SUTRO**, ALFRED (1863-1933), British dramatist, educated at the City of London School and at Brussels. His plays include *The Cave of Illusion* (1900), *Foolish Virgins* (1904), *Freedom* (1916), and *Living Together* (1929). He produced many dramas in London.

**SUTRO**, THEODORE (1845-1927), American lawyer and author, born in Prussia, who was brought to the United States in 1850. After graduating from Harvard University and from Columbia University Law School he was admitted to the New York bar. From 1895 to 1898 he was commissioner of taxes for New York City, and for several years after this was the editor of *Das Deutsche Journal*. He wrote *The Sutro Tunnel Co. and the Sutro Tunnel* (1887), *Thirteen Chapters of American History* (1905), and many articles on taxation, corporation law, and mining.

**SUTTEE** (from Skr. *sati*, "true wife"), the practice which prevailed in India of a wife burning herself on the funeral pile, either with the body of her husband, or separately if he had died at a distance. Classical authors mention it as early as 600 B.C. It appears at first to have been a royal custom and privilege, afterward generalized and made legal. The custom was abolished by the British in 1829, but it has continued to the present time in isolated parts of India.

**SUTTER**, JOHN AUGUSTUS (1803-80), pioneer in the settlement of California, born in Kandern, Baden, of Swiss parents. Sutter emigrated from Germany to the United States in 1834, settling in St. Louis and then Sante Fe. In 1838 he made his way as a trader to the Pacific coast of the Oregon region and in 1839 settled in the Sacramento valley of California, then a Mexican province. He received from the Mexican government a grant of 49,000 acres of land, and became a Mexican citizen and official. He developed a colony known as New Helvetia (now Sacramento), on which he constructed



John Sutter (from a painting)

a fort, a mill, factories, and other buildings, and which became rapidly populated by settlers, including many Americans.

In the revolt of California against Mexico (1846) which resulted in the acquisition of the province by the U.S., Sutter aided the American forces under John Charles Frémont that occupied his lands that year. To accommodate the needs of the numerous settlers who came to New Helvetia after the annexation of California by the U.S., in partnership with James Wilson Marshall (1810-85), Sutter began the erection of a new sawmill. While workmen were excavating for this project they discovered gold (January 24, 1848). Although Sutter tried to keep the news secret, it rapidly spread. The following year, a rush of gold seekers came to California from the United States and other parts of the world. They settled on Sutter's land as squatters, and stole his cattle and sheep. Many of his workmen left his employ to become goldminers. The new settlers disputed with Sutter the ownership of his lands; the case finally went to the United States Supreme Court, which found invalid Sutter's title to most of his holdings. He was then forced into bankruptcy, in 1852. California granted him, between 1864 and 1878, a pension of \$250 a month for his services in settling the State. From 1871 Sutter continually petitioned the United States Congress for recompense on the part of the Federal government, but Congress did not acknowledge his claims.

**SUTTNER, BERTHA, BARONESS VON** (1843-1914), Austrian novelist, born in Prague. She married, in 1876, Baron Arthur von Suttner (1850-1902), also known as a novelist. In 1891 she founded the Austrian Society of Peace Lovers and, as its president, took a prominent part in the peace congresses at Rome (1891), Bern (1892), Antwerp (1894), and Hamburg (1897). She edited the periodical *Die Waffen Nieder!* (Dresden, 1892 et seq.), organ of the Peace Bureau at Bern, and in 1905 received the Nobel Peace Prize. Her novels include *High Life* (1884); *Erzählte Lustspiele* (1889); *Die Waffen Nieder!* (1889; translated into English as *Lay Down Your Arms!*, 1905), and its sequel *Martha's Kinder* (1902); and *Babys siebente Liebe* (1905). She also wrote *Die Haager Friedenskonferenz*, *Tagebuchblätter* (1900); *Der Krieg und seine Bekämpfung* (1904); *Randglossen zur Zeitgeschichte* (1906); *Stimmen und Gestalten* (1907); and *Menschheit, Hochgedanken* (1912).

**SUVA**, capital and chief port of the Fiji Islands, on the southern coast of Viti Levu. European pop., about 1800.

**SUVOROV, COUNT ALEKSANDR VASIL'EVICH** (1729-1800), Russian military leader, born either in Finland or Russia, of Swedish ancestry. He entered the Russian army as a boy; served in the Seven Years' War, became a colonel in 1762 and a major general in 1768; served in 1773-74 in the Russo-Turkish War; and was commander of the Russian armies fighting against the Turks from 1787 to 1792. For his decisive victory over the Turks at the Rymnik River he received the surname "Rymnikski" and was made a count of the Holy Roman Empire. In 1799 during the War of the Second Coalition against Revolutionary France, Suvorov commanded the allied forces in northern Italy. Under his direction they won three successive victories, at Cassano d'Adda, the Trebbia River, and Novi, and drove the French out of the region. For these successes he was given the added surname "Italiski". Suvorov then led his armies into Switzerland to effect a junction with Russian forces fighting the French there; however, he was forced by the French to retreat to Vorarlberg, Austria. His leadership of the retreat was skillful, but when he returned to St. Petersburg the following year he was dismissed from his post by the czar Paul I and died of illness shortly afterward. However, a monument was erected to him in 1801 by Czar Alexander I. Suvorov was the



uncle of the Russian soldier and statesman Prince Aleksandr Ivanovich Gorchakov.

**SUWANEE RIVER**, river rising in southern Georgia, in the Okefinokee Swamp, and flowing in a winding, generally s.s.w., course through Florida into the Gulf of Mexico, about 15 miles n.n.w. of Cedar Keys. Its length is 240 m. It is the river of the celebrated song "The Old Folks at Home".

**SUYUTI** (1445-1505), Arabic encyclopedist, and the most prolific writer in Arabic literature. His family was of Persian origin, but had emigrated to Egypt, where his father was a judge and professor at Cairo. Hither the son returned after the usual travels to Mecca and the centers of learning, and here he rose from one professorship to another. But at last his arrogant and dishonest conduct drove him from his position, and he died in retirement. The production of great numbers of books seems to have been his affectation, and although they do not reveal genius, they are of value for the encyclopedic information they contain. More than five hundred titles of great books of his are enumerated, touching upon every subject.

**SVALBARD**, formerly SPITSBERGEN, an Arctic archipelago in the Eastern Hemisphere. It comprises all lands between 10° and 35° E. longitude and between 74° and 81° N. latitude. The principal islands are West Spitsbergen, Northeast Land, Barents Island, Edge Island, King Karl's Land, Hope Island, Bear Island, and Prince Charles Foreland. Norway assumed control in 1925. It has been estimated that there are in West Spitsbergen 8000 million tons of coal, of which 1500 million tons are of excellent quality. Mining activities are centered in Ice Fiord, where there are six camps. Coal exports in a recent year totaled 500,000 tons. King's Bay is known as the base for most of the aerial expeditions in the Arctic Sea. The total population numbers about 1500 in the winter and is larger in summer. Wireless stations and postal service are maintained. Area, about 25,000 sq.m.

**SVARAJ** (fr. Skr. *sva*, "self" *raja*, "government"), or **SWARAJ**, in former British India, self-government; by extension, cultural and political development under native influence as distinguished from such development under British influence.

**SVARGA** (Skr., "heaven"), in Hindu mythology, the paradise of the god Indra (q.v.). It is the residence of some of the inferior gods and deified mortals, who there rest in the shade of five wonderful trees,

drink *amrita*, the beverage of immortality, and enjoy the music of the heavenly musicians, the *Gandharvas*, and the dancing of the celestial courtesans, the *Apsarasas*. Svarga is situated on Mount Meru (q.v.) and is said to be 800 miles in circumference and 80 miles high. Its pillars are of diamonds and its palaces of gold.

**SYEABORG**, a fortress of Finland, sometimes called "the Gibraltar of the North". It protects the harbor and town of Helsingfors. See **HELSINKI**.

**SVEDBERG**, **THE**, in full **THEODOR** (1884- ), Swedish chemist, born in Valbo, and educated at the University of Uppsala. He was appointed docent at the University of Uppsala in 1909, and in 1912 became professor of physical chemistry. He served also as director of the Institute of Physical Chemistry. About 1920 he developed the ultracentrifuge (see **CLNTRIFUGE**). Svedberg is known for his researches in colloid chemistry, particularly that of dispersed systems (see **COLLOIDAL DISPERSION**), for which he received the Nobel Prize in chemistry in 1926. Among his works are *Colloidal Chemistry* (2nd ed., 1928) and *The Ultracentrifuge* (1939).

**SVENDBORG**, seaport and capital of the county of the same name on the s.e. coast of the Danish island of Fyn. The harbor admits vessels drawing up to 20 ft. of water. A major industry of the county is the growing of wine grapes and the production of wines. Area of county, 643 sq.m.; pop., about 144,000. Pop. of city, about 21,500.

**SVENDSEN**, **JOHAN** (1840-1911), Norwegian violinist and composer, born in Christiania, and trained at the Leipzig Conservatory. He toured extensively, later was appointed concert master of the Leipzig Eutype concerts, and from 1872 to 1877 was conductor of the Christiania Musical Association. In 1883 he became court conductor at Copenhagen. Svendsen is one of the most important of Scandinavian composers, although his music shows few distinctly national characteristics. His works include string quartets and quintets; two symphonies, in D and B flat; violin concerto in A; an overture to Bjørnstjerne Bjørnson's drama *Sigurd Slembe*; *Carnaval à Paris*, for orchestra; *Wedding Cantata*, for chorus and orchestra; *Carnaval des Artistes Norvégiens*; a legend for orchestra, *Zorahayde*; Norwegian rhapsodies for the orchestra; overture to *Romeo and Juliet*; Scandinavian airs for string quartet; and a *Romance* in G, for the violin and orchestra.

**SVENGALI**, a sinister character in George Du Maurier's (q.v.) novel, *Trilby*. Svengali possessed hypnotic powers and through them transferred his musical knowledge to the heroine of that story, making her a great singer. When his influence over her was destroyed, she could no longer sing.

**SVERDLOVSK**, formerly EKATERINBURG, administrative center of the Region of the same name in Soviet Russia. The city is situated on the Isset R., on the E. slope of the Ural Mts., about 180 miles S.E. of Perm (or Molotov) and 1200 miles E.N.E. of Moscow. Sverdlovsk, an industrial and railroad center, lies in an area noted for the mining of coal, gold, bauxite, copper, platinum, and chromium. Among the large industrial works in the city are platinum refineries, copper and iron smelters, and factories producing mining machinery, machine and precision tools, furnace equipment, and linen goods. Large electric-power stations supply the various industrial establishments. The city was founded by Peter the Great in 1721. In 1918 Sverdlovsk was the site of the assassination of Czar Nicholas II and his family. Following the Revolution of 1917 the city, during the Russian Civil War, was at one time captured by a Czech army (see UNION OF SOVIET SOCIALIST REPUBLICS: *History*). Pop., about 425,500.

**SVERDRUP, GEORG** (1770-1850), Norwegian scholar and statesman, born in Namdalen, and educated at the University of Göttingen. He became professor of Greek at the University of Copenhagen in 1803. He did much for the establishment of Christiania University, where for many years he was professor of Greek and Latin and later of philosophy. He was president of the Assembly at Eidsvold (1814) which drafted the constitution of Norway. Sverdrup was one of the leaders of the majority which offered to Prince Christian Frederik the crown of Norway. His services as member of the Storthings of 1818 and 1824 were also important.

**SVERDRUP, HARALD ULRIK** (1888- ), Norwegian oceanographer and arctic explorer, born in Sogndal, and educated at the University of Oslo. He was in charge of the scientific work on the Arctic expedition of the ship *Maud* from 1917 to 1925, and on the submarine *Nautilus* in 1931. He was professor of meteorology at the Geophysical Institute of Bergen, Norway, from 1926 to 1930, and in 1936 he became professor of oceanography and director of the Scripps

Institution for Oceanography at the University of California, serving in both posts until 1947. In the following year he became chairman of the Norwegian Polar Institute. He was member of many Norwegian and American scientific societies, and won many honors and awards. His works include *Oceanography for Meteorologists* (1942).

**SVERDRUP, JOHAN** (1816-92), Norwegian statesman, born in Jarlsberg. He studied and practiced law, but from 1850, when he was elected to the Storting, gave his entire attention to politics and became the leader of the radical peasant party. As president of the Storting beginning in 1871 he violently fought against the royal prerogatives. He was called to preside over the ministry in 1884, but did not satisfy the radical portion of his adherents and, yielding to the combined attacks of the Conservatives and the extreme Left, resigned in 1889. His work greatly furthered the development of popular government in Norway.

**SVERDRUP, OTTO** (1855-1930), Norwegian arctic explorer, born in Helgoland. In 1895 he started with Nansen for the North Pole as commander of the *Fram*, which had been built under his supervision, and when Nansen, in 1895, left the *Fram* in an attempt to reach the North Pole by dog sledge, Sverdrup, remaining with the ship, brought her safely to Norway through the ice.

He led another expedition in the *Fram* (1898-1902) in an unsuccessful attempt to circumnavigate Greenland. Unable to pass north of Cape Sabine, Smith Sound, he transferred his field of operations the second summer to Jones Sound, where his explorations and discoveries include Heiberg and Ringnes lands, the most westerly coasts of Grinnell Land, and regions adjacent to Greely Fiord. He wrote *New Land: Four Years in the Arctic Regions* (1904).

**SVERDRUP ISLANDS**, a group of islands in the Canadian Arctic, west of Ellesmere Land, the Canadian title to which was formally recognized by the government of Norway in 1931. The Sverdrup group was discovered and explored in 1898-1902 by Otto Sverdrup. The Canadian government, in return for the withdrawal of Norway's claims, paid Sverdrup \$67,000 and promised to accord favorable treatment to Norwegian hunters and fishermen in the territory.

**SWABIA**, or SUABIA (Ger. *Schwaben*, Lat. *Suevia*), a medieval duchy in the southwest of Germany. It took its name from the

Suevi, by which the Germanic people of the Alemanni who occupied southwestern Germany in the 3rd century were also known. The region occupied by the Alemanni embraced western Bavaria, Württemberg, Baden, Alsace, and a great part of Switzerland. It is now a district of the Republic of Bavaria. The capital is Augsburg. Area, 3807 sq.m.; pop., about 860,000.

**SWABIAN LEAGUE**, name of several confederations of German cities formed in the Duchy of Swabia and contiguous principalities at various times in the 14th and 15th centuries. The first Swabian League was established in 1331; it comprised twenty-two cities, including Augsburg and Ulm (qq.v.), which at that time, under the leadership of the rising bourgeoisie (q.v.), were striving for local independence from the oppressive rule of their noble overlords. The league was formed on the initiative of the Holy Roman emperor Louis IV of Bavaria, who was engaged in a struggle for recognition as emperor with Pope John XXII and for control in his domain with the princelings of his realm. In return for the support of the Swabian cities against his enemies, Louis promised not to subordinate the cities to the counts, dukes, and other lords of the realm. Later, a number of the nobles combined against the growing power of the Swabian League, and civil war resulted. In 1367 the Holy Roman emperor Charles IV, disturbed by the strength of the league, became hostile to it. This Swabian League was defeated by its enemies in 1372 and was subsequently dissolved.

A new association of fourteen Swabian cities, with Ulm as its most important member, was formed in 1376. Among its objectives were continuance of the subjection of the cities to imperial authority, in return for a promise by the emperor not to mortgage or sell the constituent members of the league, and an agreement by him not to levy onerous taxes; the establishment of security of private property and commerce; and the preservation of domestic order by the suppression of disturbances. The second Swabian League became a powerful association because of the support of the emperor, who had removed the imperial ban against such confederations, and as a result of a decisive military victory in 1377 over the league's chief enemy, the Count of Württemberg. It grew rapidly thereafter and included cities in Bavaria, Franconia, and the Rhineland. Although it included cities in areas in which

the Hanseatic League (q.v.) also was entrenched, and although the two associations were virtually identical in social composition and economic purpose, no record has been found that they ever co-operated. While the Hanseatic League continued to flourish, the Swabian League declined.

During the greater part of the 15th century, the Swabian nobles engaged in political warfare with the cities, infringing on their rights and creating a situation which developed in the direction of anarchy. The cities protested violently against the abuses to which they were subjected and formed a number of short-lived associations. Finally, the emperor Frederick III, who found it difficult because of the disturbed conditions in his realm to raise money and men for the war with Hungary in which he was engaged, proposed a plan for the pacification of Swabia, which included the formation of a confederation of cities and nobles and which led to the establishment in February, 1488, of the Great Swabian League.

This association, which was granted a constitution by the emperor, comprised four main constituent parties. One was made up of twenty-two Swabian cities; another was the knightly order called the League of St. George; the third was led by Archduke Sigismund of Austria; and the fourth was led by Count Eberhard V of Württemberg, who was made captain, or chief executive officer, of the league. The captain governed the league under the imperial crown, in conjunction with the federal council and the federal court provided for in the league constitution. To police Swabia the league had at its disposal 12,000 infantry and 1200 cavalrymen. Until its dissolution in 1534, the Great Swabian League accomplished its principal purpose of maintaining order. During this time it was strong enough to compel Duke Albert of Bavaria in 1492 to relinquish the Swabian city of Regensburg, annexed by him six years before. In 1525 the league participated in the suppression of uprisings at Ingolstadt and Königshofen; see GERMANY: *History*.

**SWAHILI**, the name given to the people of Zanzibar and the coast of Kenya and Tanganyika Territory belonging to the Bantu stock, with an Arab infusion, and speaking a Bantu tongue modified by Arabic. The Swahili are intelligent and enterprising, their language, Kiswahili, being the medium of intercourse throughout east central Africa. There is a collection of Swahili folk tales



*The cliff swallow*

(1869), a handbook by Steere (1882), and a dictionary by Madan (1904).

**SWAINSBORO**, county seat of Emanuel Co., Ga., situated about 85 miles n.w. of Savannah. It is served by two railroads, and is the center of an area producing cotton, peanuts, and timber. The region is also noted for quail hunting. Pop. (1950) 4300.

**SWALLOW**, a genus, *Hirundo*, and family, Hirundinidae, of Passerine birds. The mem-

bers of this family are distinguished by their long and pointed wings, long head, slender wide bill, small legs and feet, and tail generally forked. The genus is cosmopolitan in distribution, and contains about sixty species. The members are gregarious, and prefer well-cultivated districts and the proximity of water. They have great powers of flight and perch but little, catching their prey on the wing. Swallows, because of their insectivorous diet, are of considerable economic value. Flies, mosquitoes, and gnats, as well as many insects injurious to crops, form the bulk of their food. The plumage of the common swallow is very beautiful, the upper parts and a band across the breast glossy bluish black, the forehead and throat chestnut, the lower parts white, and a patch of white on the inner web of each of the tail feathers except the two middle ones. The nest, probably originally built in caves, is made of mud or clay, formed into little pellets and stuck together with straw and grasses, and lined with feathers.

Only eight species occur in North America, and all but one of these winter south of the United States, though in summer they range to the Arctic. The largest species is the purple martin; the smallest is the bank swallow. Perhaps the commonest of North American swallows is the barn swallow. Another swallow numerous about farmyards and barns is the cliff or eaves swallow, *Petrochelidon lunifrons*, whose nest is the remarkable flask-shaped structure of pellets of mud often seen attached in rows to the outside walls of barns, near the eaves. Formerly, as in the case of other swallows (see **BARN SWALLOW**), this species bred in rocky places and placed its nests in large companies against the faces of cliffs. A large and handsome swallow common throughout North America is the white-bellied or tree swallow, *Tachycineta*, or *Iridoprocne*, *bicolor*, steel blue or green above and pure white beneath. Of the same genus is the exquisite little violet-green swallow, *T. thalassina*, of the western United States, less than 5 inches long; its upper parts are velvety green and violet purple, while the under parts are pure white. The rough-winged swallow completes the list.

In Great Britain *Hirundo rustica*, the common or chimney swallow (to be distinguished from the American chimney swift), is much like the barn swallow and makes a similar nest, usually placed under a shed roof, in a half-ruined building, or often in a chimney.



*Swallowtail butterflies*



*Common swan (Cygnus olor) beginning flight from a pond*

The window swallow or house martin (*P. urbana*), is another very common European species glossy black above white below and on the rump the feet covered with short downy white feathers which distinguish it from the chimney swallow.

**SWALLOWTAIL**, any member of a family of large butterflies Papilionidae with tail-like prolongations of the hind wings. Black, yellow, blue and green are the prevailing colors. About 35 species occur in the United States. South America is most rich in these butterflies. About 850 species have been described in all.

**SWAMMERDAM, JAN** (1677-80) Dutch naturalist, born in Amsterdam. He studied medicine at Leyden but devoted most of his life to the study of insects and other animals. He was a skilled dissector of small animals and was the father of scientific study of the morphology and metamorphosis of insects. He first made a natural classification of insects by distinguishing between those which have a complete metamorphosis and those which have not. He wrote *Tractatus de Respiratione usque Pulmonum* (1667), *Allgemeene Verhandelinge van Bloedloose Dierjes* (1669), and *Biblia Naturæ sive Historia Insectorum in Certain Classibus Redacta* (published posthumously 1737-38).

**SWAMP**, an area of wet ground usually covered with certain coarse grasses, trees and other plants peculiar to such land. Drainage seems to be the principal controlling factor in producing typically different swamps. In undrained swamps acids and

the products of plant decay together with various other excretions accumulate while the soil is relatively cold and poorly oxygenated. Hence conditions are relatively unfavorable for plant growth and many xerophytes are found in such places. River swamps being comparatively well drained afford somewhat better habitats and are dominated by hardy phytes. Vegetation is more or less xerophytic in peat bogs or moors and salt marshes.

**SWAMPSCOTT**, a town of Essex Co., Mass. situated on Massachusetts Bay 13 miles N. of Boston. Transportation facilities include railroad. Swampscott is a residential community and a noted summer resort. Among the buildings of interest in the town is the Humphrey House built in 1635 for John Humphrey, deputy governor of the Massachusetts Bay Colony at the time. It now contains the collection of the Swampscott Historical Society. Another building of note is the Mary Baker Eddy House, former residence of the founder of the Christian Science Church. Swampscott was settled in 1630 and incorporated as a town in 1857. Pop. (1950) 11,580.

**SWAN** (*Cygnus*) a genus of water birds constituting a distinct section of the duck family Anatidae. Swans are larger than geese and are recognizable by their long arched necks enabling them to reach food on the bottom of streams and shallow ponds without diving. They nest mostly in high latitudes constructing on the ground a rude receptacle of rushes and the like for the

half-dozen greenish eggs. They feed chiefly on vegetable substances, as the seeds and roots of aquatic plants, but also on fish spawn, of which they are great destroyers. They hiss like geese and strike with their wings in attack or defense. The common swan, mute swan, or tame swan, *C. olor*, is about 5 ft. in length, and weighs about 30 lbs.

It is known to live for at least fifty years, and is said to pair for life. The adults of both sexes are pure white, with a reddish bill; the young (cygnets) have a dark bluish-gray plumage and lead-colored bill. The bill is surmounted by a black knob at the base of the upper mandible, and has a black nail at its tip. The wild swan, or whooper, *C. ferus* or *musicus*, abounds in the northern parts of Europe and Asia.

The American swan, *C. americanus*, breeds in the northern parts of North America, but its winter migrations extend only to North Carolina. The trumpeter swan, *C. buccinator*, one of the largest species and noted for its sonorous cry, is another American species breeding chiefly within the Arctic Circle, but of which large flocks may be seen in winter as far south as Texas.

**SWAN, JOHN MACALLAN** (1847-1910), English sculptor and painter, born in Old Brentford. In 1880 his picture "The Prodigal Son" was bought for the Chantrey Collection (Tate Gallery, London). Among his best-known paintings are "Orpheus", "A Dead Herod", "Lioness Defending Her Cubs", and "Polar Bears Swimming". His works in sculpture include "Boy and Bear Cubs", "The Wounded Leopard", and "Puma and Macaw".

**SWAN, SIR JOSEPH WILSON** (1828-1914), English inventor, born in Sunderland. He made several inventions of great value, among them the carbon photographic process called autotype, a miner's electric safety lamp, improvements in electrometallurgical deposition, but most notable of all an incandescent electric lamp. In 1879 he exhibited a lamp with a filament of carbon in a vacuum bulb and followed this by various improvements. These inventions brought him many honors, including a fellowship in the Royal Society and knighthood (1904).

**SWANEE RIVER.** See SUWANEE RIVER.

**SWAN, KNIGHT OF THE**, a very old and popular myth found in French, German, and English medieval romances, first mentioned about 1180. Helias, Knight of the Swan, is one of eight children of Oriant of Lilefort.

Seven are changed to swans, one drawing the hero in a boat to become champion for Clarissa of Bouillon, the ancestor of the French Crusade leader Godfrey of Bouillon, thus connecting the story with the Crusades. After marriage the knight departs when his wife breaks the taboo on his name, a Grail feature common to all variants, as *Lohengrin*, showing its partly Celtic origin. The scene is generally on the lower Rhine, connecting it with the dukes of Briabant and Cleves, whose symbol was a swan.

**SWANN, WILLIAM FRANCIS GRAY** (1884- ), Anglo-American physicist, born in Ironbridge, Shropshire, England, and educated at the University of London. After teaching at various English technical institutes and universities, he moved to the United States, becoming chief of the physical division in the department of terrestrial magnetism of the Carnegie Institute, Washington, D.C., in 1913. He was professor of physics at the University of Minnesota from 1918 to 1923, and at the University of Chicago in 1923-24. In 1924 he became professor of physics and director of the Sloan Laboratory at Yale University, serving there until 1927, when he became chairman of the Advisory Committee of the Bartol Research Foundation of the Franklin Institute at Philadelphia. He became director of the Foundation in 1927. Swann is noted for his work in cosmic rays, atomic structure, relativity, heat measurement, and electric conductivity. Among his works are *Architecture of the Universe* (1934) and *Physics* (1941).

**SWANSEA**, a township of Bristol Co., Mass., situated on an arm of Mount Hope Bay, about 5 miles N. of Fall River. It comprises several villages, including North Swansea and Swansea Center. Swansea was a part of Rehoboth until 1668. Pop. (1950) 6121.

**SWANSEA**, a seaport in Glamorganshire, South Wales, at the mouth of the Tawe, 60 miles W.N.W. of Bristol. Swansea is the chief seat of the tin-plate trade of England and one of the most important copper smelting and refining centers in the world. The vast resources of the surrounding coal fields began to be exploited about 1830, and since that time the progress of Swansea has made it, next to Cardiff, the most important town in South Wales. Swansea owes its origin to a castle erected in 1099. In 1260 the castle was burned down. It was twice rebuilt, but was finally dismantled by the Parliamentarians in 1647 and is now an interesting ruin. Pop. (1951 prelim.) 160,832.

**SWANSON, GLORIA** (?- ), American actress, born in Chicago. Beginning as an "extra" in the early days of motion pictures, she advanced rapidly until stardom was attained in *Male and Female*, a motion picture based on Barrie's *Admirable Crichton*. Others of her outstanding pictures were *Zaza*, *Madame Sans Gêne*, *The Loves of Sonya*, *Sadie Thompson*, and *Indiscreet*. In 1950, after an extended period of retirement, she returned to the screen in *Sunset Boulevard*, and also established a successful television program.

**SWANWICK, ANNA** (1813-99), English author and feminist, born in Liverpool. In Berlin she studied German, Greek, and Hebrew, and after settling in London took up mathematics also. Her volumes of translations include *Selections from the Dramas of Goethe and Schiller* (1843), *Faust*, *Tasso*, *Iphigenie*, and *Egmont* (1850), a complete translation of *Æschylus* (1873), and *Faust* (1878). Both in the case of the German writer Johann Wolfgang von Goethe and of the ancient Greek dramatist *Æschylus*, her translations still remain "the best." She also assisted in the founding of Girton College and Somerville Hall, Cambridge, advocated the study of English literature in the universities, and signed John Stuart Mill's petition to Parliament for the political enfranchisement of women. To the feminism of her time her career was notably stimulating. Besides her translations, Miss Swanwick wrote several books of her own.

**SWARTHMORE**, a borough of Delaware Co., Pa., near the Delaware R. and 11 m. by rail s.w. of Philadelphia, of which it is a suburb. It is the site of Swarthmore College (q.v.). The borough, one of the early Quaker settlements in the State, was the birthplace (1738) of Benjamin West, the noted American painter who became president (1792-1820) of the Royal Academy of Arts in England. Swarthmore was incorporated as a borough in 1893. Pop. (1950) 4825.

**SWARTHMORE COLLEGE**, a privately controlled, coeducational institution of higher education, situated at Swarthmore, Pa. It was chartered in 1864 by the Society of Friends (q.v.), and was opened for instruction in 1869. Regular courses leading to an A.B. degree in the liberal arts and a B.S. degree in engineering are offered. An honors program of study leading to the same degrees is also in effect. Students following this program attend regular classes for only two years; during the second two years they prepare privately, under faculty supervision,

for written and oral examinations given at the end of the senior year. This system, an innovation in undergraduate schools, was instituted by Frank Aydelotte (q.v.), a former president of the college. In a recent year the enrollment was about 900, the faculty consisted of over 120 members, and the library included over 161,000 volumes.

**SWASTIKA**. See FYLFOT.

**SWATOW**, a seaport of Kwangtung Province, China, at the mouth of the river Han. It is the seat of large sugar refineries and bean-cake and grass-cloth manufactures. Pop., about 180,000.

**SWATS**, a people of the Indo-Afghan frontier, belonging by race and language to the Aryan stock. Their country, called Swat, is traversed by a river of the same name, an affluent of the Kabul, and is included in the North-West Frontier Province of Pakistan. After having been nearly exterminated at the end of the 16th century, the Swats came under the religious dominance of Abdul Ghafur (1794-1877), who was practically their ruler during his last years. Fanatical Mohammedans, the Swats gave the British government much trouble in 1895 and 1897.

**SWAZILAND**, a British protectorate in S. Africa, bounded on the E. by Mozambique, and on the S, S. W., and N. by the Transvaal Province of the Union of South Africa. The capital is Mbabane (White pop., about 500). Area, 6705 sq. m.; pop. (1951 est.) 200,000, of which more than 90 percent are natives.

Swaziland is roughly oval shaped. The elevation of the land decreases from W. to E. The mountainous W. portion possesses an altitude exceeding 4000 ft. above sea level. The central region, or veld (grassland), possesses an elevation of about 2000 ft., and the eastern region, or low veld, averages from 400 to 1000 ft. above sea level, and is bounded on the E. by the Lebombo Mts. The principal rivers are the Komati, Umbelozi, and Usutu. Rainfall is light in the E., and heavier toward the W. The climate is healthful except during the summer months, when it is hot and malaria is prevalent in the low veld.

The principal industries are farming and cattle raising. The chief crops are cotton, tobacco, corn, sorghums, pumpkins, ground-nuts, beans, sweet potatoes, apricots, pears, apples, peaches, and citrus fruits. Livestock includes about 417,000 cattle, 143,000 goats and sheep, 17,000 mules and donkeys, 8000 pigs, and 2000 horses. Mining is important,



British Information Service

*Native huts in a village of Swaziland, Africa*

yielding asbestos, gold, tinstone, and barite. Geological surveys have uncovered the presence of iron ore, anthracite coal, and other minerals. The principal exports are asbestos, cattle, hides and skins, butter, and tobacco. No railroads extend into Swaziland; a motor bus service connecting Mbabane with several other points is provided by the railroad administration of the Union of South Africa. The native inhabitants are Swazis, a Bantu tribe of Zulu origin.

By an Anglo-Boer convention of 1894 Swaziland was placed under the administration of the South African Republic (see SOUTH AFRICAN WAR, TRANSVAAL). Administration passed to the governor of Transvaal in 1903, and to the High Commissioner for South Africa in 1906. The territory is presently administered by a resident commissioner acting for the High Commissioner for the British High Commission Territories in South Africa, and a European advisory council for European affairs. Native chiefs rule their tribes. Swaziland is united with the Union of South Africa for customs purposes, and receives a proportionate share of the customs dues collected. Judicial authority is vested in a high court and subordinate courts. Civil matters among natives

are handled by the native chiefs, subject to appeals to the high court.

**SWEARING**, in the profane sense, a term denoting the practice of raising the name of the Deity or mentioning His name or something connected with Him in an irreverent or blasphemous manner in temper or for emphasis.

The variety of oaths that have been invented is infinite and curious. The Romans swore by Hercules, by Castor and Pollux, and other divinities. In modern times many profane oaths have become disguised in form so that their original signification is no longer thought of. Thus the French exclamations "Parbleu" and "Corbleu" are merely corruptions of "par Dieu" ("by God") and "corps de Dieu" ("God's body") respectively. The old English oaths "Sdeath" and "Zounds", were originally "God's death" and "God's wounds". Nothing strikes Americans and Britishers visiting the continent of Europe more forcibly than the frequency with which such words as "Dieu", "Gott", and "Dio" are used in everyday life. In some countries the various forms of appeals to God, Christ, or the Virgin indicate different emotions. The church has always denounced profane swearing as a heinous offense. Local





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*Town Hall tower seen from Klara Strand in Stockholm, Sweden*

and municipal regulations generally forbid sweating in public places, and it is under these that offenders may be prosecuted.

**SWEAT**, the moisture exuded by the skin, in which about 2 percent of solid matter is present, consisting of salt; formic, acetic, butyric, and other fatty acids, neutral fats; and cholesterol. See SKIN.

**SWEATING SICKNESS**, or MILIARY FEVER, a pestilential disease characterized by pyrexia, profuse sweats, and an eruption of miliary vesicles or sudamina. At one time it was epidemic over a large part of Europe, and was very fatal in Britain in the 15th and 16th centuries. In modern times slight epidemics have occurred in Picardy and in the north of Italy.

**SWEDEN**, a constitutional monarchy in N. Europe, occupying the E. and larger portion of the Scandinavian peninsula, bounded on the N. by Norway and Finland, on the E. by Finland, the Gulf of Bothnia, and the Baltic Sea, and on the W. by the Kattegat (an arm of the North Sea) and Norway. Sweden consists of three main geographical regions: Götaland in the extreme S., Svealand in the central portion, and Norrland in the N., the last-named extending into Lapland (q.v.)

and larger than the first two combined. The capital and largest city of Sweden is Stockholm; other important cities include Göteborg, Malmö, Norrköping, and Helsingborg (qq.v.). Area, 173,378 sq.m.; pop. (1950 prelim.) 7,043,701.

Sweden has an extreme length of about 990 m. and a maximum width of about 250 m. The terrain is, generally, a broad, undulating plateau which slopes from the Kjolen Mts., along the Swedish-Norwegian border, to the S. and E. The Swedish coast is deeply indented, forming large bays or fiords, studded with islands of which the largest are Öland and Gotland in the Baltic Sea. The fertile plains of Götaland are the most productive farming region. In Svealand and Norrland are deposits of iron ore which are among the most valuable in Europe; other important Swedish minerals are zinc, copper, silver, lead, bauxite, and manganese. Norrland is covered with dense forests which extend beyond the Arctic Circle. Forests cover more than half the total area of Sweden. Lakes and rivers cover an additional 8% of the Swedish area. The four largest lakes, Vener (third largest in Europe), Vetter, Hjälmars, and Mälars, are in the S. Many rivers flow from the mountains S.E. to the

Gulf of Bothnia gr. the Baltic, providing considerable water power but, because of their swiftness, negligible facilities for navigation. The largest Swedish river is the Klar Elf, which flows from Norway and empties into Lake Vener. Sweden has short summers and long, extremely cold winters; spring is almost nonexistent. In the N. lakes are frozen and snow covers the ground for five to six months a year. At Stockholm the mean temperature in January is about 25°F. and in July about 61°F. The w. mountains prevent much precipitation from reaching the E. plateau and plains, and mean annual rainfall is less than 20 in., the greatest rainfall (35 in.) falling on the w. coast. Pines and firs predominate in the Swedish forests; in the s. grow deciduous trees such as beeches and oaks. Among the Swedish wild animals are the reindeer and bear, both protected by law, and the lynx, wolf, fox, badger, otter, and lemming.

**Production and Industry.** Sweden is an agricultural country, although little more than 9 percent of the total area is under cultivation. The leading grain crops are oats (884,000 metric tons in a recent year), wheat (783,000 m. tons), and rye (290,000 m. tons). Other leading crops include potatoes (1,751,000 m. tons) and sugar beets (1,732,000 m. tons). The raising of livestock is important; recently there were about 2,633,000 cattle, 1,331,000 swine, 415,000 horses, and 261,000 sheep. Co-operatives, especially for marketing purposes, are an important feature of the agricultural industry (see CO-OPERATIVE MOVEMENT).

Mining is the leading industry. Mineral and metallurgical production in a recent year included iron ore (16,116,000 metric tons), pig iron (852,000 m. tons), and crude steel (1,500,000 m. tons). Other leading mineral and metallurgical products are ferro-alloys, manganese ore, tungsten, copper, zinc, aluminum, shale oil, and paving stone. Ball bearings, cream separators, lighthouse apparatus, motors, and many kinds of electrical machinery are produced by the Swedish metallurgical industries. Timber industries are very important, and in a recent year the production of the approximately 1100 saw-mills and planing mills in Sweden was valued at 677,000,000 kronor. Other wood industries include the making of furniture, wood pulp, paper, and pasteboard. By value, timber, wood pulp, and paper account for almost one half the total Swedish exports. Fur production in a recent year included 53,000 pelts

of several varieties of fox. In a recent year the fish catch, almost entirely from the s.w. coast, was valued at about 102,000,000 kronor. Swedish imports, in a recent year, were valued at 9,190,000,000 kronor. and exports at 9,170,000,000 kronor. Trade is principally with Great Britain and West Germany.

**People, Language, and Religion.** Sweden has an almost entirely homogenous population. Minorities include about 7200 Lapps and 30,000 Finns, living chiefly in the N., about 26,000 other Scandinavians, and about 20,000 Estonians. The Swedes belong to the Scandinavian branch of the Teutonic race, and are considered the purest and most numerous branch of that ethnologic group. In general, they are tall, blue-eyed, and fair-haired. The prevailing language is Swedish, one of the Germanic languages (see SWEDISH LANGUAGE AND LITERATURE). About 99 per cent of the people belong to the Evangelical Lutheran Church, which is recognized as the Swedish state church. All citizens must pay contributions to that Church, and the state controls its property and supports its clergy.

**Education and Social Legislation.** Education in the public elementary schools is free and compulsory between the ages of seven and fourteen; children not attending state schools must furnish proof that they are being educated privately. In a recent year about 650,000 students attended elementary schools and about 143,000 students attended secondary schools. In addition, military, navigation, agricultural, veterinary, and other special schools are part of the Swedish educational system. The state universities at Uppsala (1477) and Lund (1668), and the private, though state-aided, universities at Stockholm (1877) and Göteborg (1889), have a combined student body of over 11,000 students. Sweden has one of the lowest illiteracy rates in the world. See EDUCATION, NATIONAL SYSTEMS OF: Sweden.

Sweden is noted for its advanced system of social insurance and legislation. This system includes allowances for all children under sixteen and pensions for all persons of sixty-seven or more, regardless of economic circumstance. Other benefits paid by the state include unemployment insurance, health insurance, maternity benefits, workmen's compensation, poor relief, and child-welfare funds. Public-works projects are always in readiness for possible unemployment, and housing loans and grants are given by the government.

**Communications.** Swedish communications



Swedish National Travel Office

Above: Aerial view of Malmö, Sweden. Right: Skärstorp Church, Västergötland, Sweden.

include 56,200 m. of roads and about 16,640 kilometers (10,333 m.) of railroad, of which 15,166 kms. (9418 m.) are owned and operated by the state. Domestic air-line services link the principal Swedish cities, and air passenger and freight service connects Stockholm with other cities of the world.

**Government.** Sweden is a hereditary monarchy governed under a constitution adopted in 1809. In addition to the constitution, three fundamental laws form the basis of Swedish government. They are: the Act of Settlement (1810, providing for the succession to the throne), the law on the freedom of the press (1949), and the organic law for the *Riksdag*, the parliament (1866, with subsequent modifications). Executive and judicial authority is vested in the king and council (*Statsrådet*), or cabinet; the latter, headed by a prime minister, is responsible to the *Riksdag*. Legislative authority is vested in the *Riksdag*. The king, however, has an absolute veto on legislation, and may initiate laws, excepting tax legislation. The *Riksdag* is composed of two chambers. The First Chamber consists of 150 members, about one eighth of whom are elected annually for eight-year terms by the *Landstingen* or county councils, and by the town councils of the six large cities not



repres. ed in *Landstingen*. The Second Chamber consists of 230 members, elected for four-year terms by universal suffrage of citizens twenty-one years of age and over. Election is by proportional representation. For purposes of local administration, Sweden is divided into twenty-four *läns* or counties, and the city of Stockholm.



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*Above: Fortress of Varberg on the western coast of Sweden, a formidable stronghold in the 15th and 16th centuries. Left: 11th-century tombstone found on the Swedish island of Öland in the Baltic Sea.*

**History.** During Roman times, the e. half of the Scandinavian peninsula was inhabited by two great Germanic tribes, the Suiones, or Swedes, in n. Svealand, and the Gothones, or Goths, in s. Gothia. These tribes, although united in religious beliefs (see SCANDINAVIAN MYTHOLOGY), were generally at war with one another. Previous to the 10th century, details of Swedish history are obscure. In the first half of the 9th century Frankish missionaries began teaching Christianity, which slowly became established in the country. Olaf Skutkonung (ruled 993-1024)

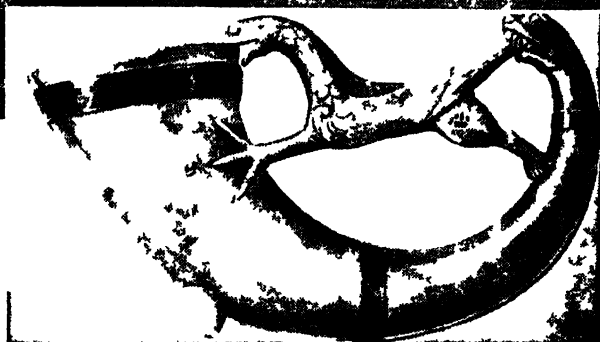
was the first Swedish king to become a Christian. Under Eric IX (ruled 1150-60), who later became the patron saint of Sweden, Swedish power was strengthened. Eric invaded Finland and forced Christianity upon those he conquered; during the subsequent two centuries Finland was completely subjugated by the Swedes (see FINLAND: *History*). Eric was defeated and killed in 1160 by Prince Magnus Henriksön of Denmark, who made an unprovoked attack on Sweden, the first of a long series of wars between the two countries.

In the 13th and 14th centuries feudalism became a controlling influence in Sweden, and a wealthy aristocracy replaced the waning power of the throne. In 1388 the Swedish nobles deposed Albert (q.v.) of Mecklenburg and offered the crown to Margaret (q.v.), queen of Denmark and Norway. In 1397 Margaret effected the Union of Kalmar, by which the three Scandinavian kingdoms of Denmark, Norway, and Sweden were united under a single sovereign. See DENMARK: *History*; NORWAY: *History*.



America's New Exchange

Above: Gripsholm Castle, a historic Swedish landmark.  
 Right: Woolen drinking horn with bronze mount and a handle in shape of a ship, dating from the 17th century.



The union which endured for more than a century was characterized by constant dissension and wars between the Danes and Swedes. In 1520 Christian II of Denmark invaded Sweden to enforce his authority after a spirit of revolt had evicted itself. He executed a large number of the Stockholm nobles, leaders of a nationalist movement. The mass murder aroused a rebellion against the tyrant in 1521 led by Gustavus Vasa who became administrator after the successful rebellion and in 1523 king as Gustavus I (qv). Denmark however retained possession of the southern part of the peninsula.

Under Gustavus Sweden became a hereditary monarchy in which the power of the nobles was circumscribed and that of the clergy subordinated to the state. Lutheranism was established as the state religion about 1529. During the 16th century Sweden entered a period of expansion. The Reval dis-

trict of Estonia passed voluntarily under Swedish protection in 1561 and as a result of the Livonian War (1558-59) Sweden acquired from Poland all Estonia including the district of Narva. Gradually the kingdom became a power in the Baltic area, and its expansionist policies were considerably furthered by Gustavus Adolphus (qv), considered the greatest Swedish king who succeeded to the throne in 1611. At the beginning of his reign Sweden was at war with Russia (see Russia History) and in 1617 Gustavus ended the conflict with a treaty by which Sweden obtained 1,000,000 Ingömland. A war with Poland (1621-29) gave Sweden all Livonia (not formally renounced by Poland until 1660). In 1630, Gustavus, as the champion of German Protestantism, entered the Thirty Years' War (qv). The king died in 1632, but his policies were continued and brilliantly fulfilled by his chancellor, Count Axel Oxenstierna (qv),

who directed the Swedish government during the minority of the monarch's eccentric daughter, Christina (q.v.). By the Peace of Westphalia (1648), ending the Thirty Years' War, Sweden acquired a large part of Pomerania, the island of Rügen, Wismer, the sees of Bremen and Verden, and other German territory, which entitled the Swedish sovereign to three votes in the Diet of the Holy Roman Empire. Sweden then became the greatest power in the Baltic area. Pursuing his predecessor's policy of military aggression, Charles X Gustavus (ruled 1654-60) declared war on Poland (the First Northern War, 1655-60), overran that country, and by the Treaty of Oliva (May 3, 1660) Poland was finally forced to concede Livonia formally to Sweden. Charles X invaded Denmark twice in 1658, and wrested from it the provinces in extreme s. Sweden which Denmark had retained in the 16th century.

Charles' son and successor, Charles XI (ruled 1660-97), allied himself with Louis XIV of France in the French wars of the late 17th century (see FRANCE: *History*). However, Sweden, a small and not overly wealthy country, did not have the resources fully to implement such militarism despite its Baltic conquests. In 1675 the Swedes, as French allies, were severely defeated by Frederick, Elector of Brandenburg, at Fehrbellin. At the same time Charles struck at fundamental Swedish liberties in a reorganization of the Swedish government, weakening the council of state and the Riksdag, and making himself an absolute monarch. In 1680 he confiscated all large estates. Sweden again became an efficient military state, but only temporarily. His son and successor, Charles XII (q.v.), was a military genius. Not long after his accession, at the age of fifteen, he successfully engaged an aggressive coalition of Russia, Poland, and Denmark in the beginning of the Great Northern War (1700-21). During the first years of this conflict Sweden brilliantly asserted its position as the great military power of the Baltic. In 1700 Charles successfully invaded n.w. Russia and by 1706 had defeated the Poles. However, while Charles was engaging Poland, Peter the Great of Russia was establishing his dominion on the Baltic coasts. In 1709 the Swedes were completely routed by Russia at the battle of Poltava, marking the collapse of Sweden and its replacement by Russia as the dominant power in the Baltic.

By the treaties of Stockholm and Nystadt in 1721 Sweden lost much of its German territory, and ceded Livonia, Estonia, Ingermanland, part of Karelia, and several important Baltic islands to Russia.

Charles XII had died in 1718 and with him the male line of the House of Vasa. He was succeeded by his sister, Ulrika Eleanora (ruled 1718-20), conditional upon her acceptance of a new constitution destroying the absolute monarchy and vesting the legislative power in a Riksdag of four estates (nobles, clergy, burghers, and peasants). The executive power became the province of a so-called "secret committee" of the first three estates. Thus power of the aristocracy became once more the controlling factor in government, and Frederick I (ruled 1720-51), husband of Ulrika, in whose favor Ulrika abdicated in 1720, was a puppet in the hands of the nobles. However, the aristocracy was itself divided into two factions, the Hats, pro-French and supporting an aggressive policy in the Baltic to regain Swedish supremacy, and the Caps, advocating a conciliatory foreign policy and alliance with Russia, the ascendant power (see FREDERICK I.). The Hats acquired the political majority from 1738 to 1766, involving Sweden in a calamitous war with Russia (1741-43), after which Sweden was forced to cede to Russia a part of Finland.

In 1771 Gustavus III (q.v.) came to the throne and, availing himself of the general dissatisfaction with the high-handed policies of the aristocracy, managed to eliminate the Hat and Cap factions; by a *coup d'état* on Aug. 19, 1772, he took over the government and, promulgating a new constitution, restored absolute monarchy. At first his policies were liberal, but after the French Revolution of 1789 he became a despot and was assassinated in 1792. His son and successor, Gustavus IV Adolphus (q.v.), was only thirteen at his accession, and was not proclaimed king without regent until 1800. Bitterly opposed to Napoleon Bonaparte, Gustavus, in 1805, joined the Third Coalition (Great Britain, Sweden, Russia, and Austria). Russia deserted the coalition for alliance with Napoleon in 1807 and a year later invaded Finland, menacing Sweden. Gustavus was deposed by an army revolt in 1809. The Riksdag then formulated a new constitution, still in force (see *Government*, above), and elected as king the ex-king's uncle, Charles XIII (ruled 1809-18.) In 1809-10 Sweden concluded a treaty with



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*Above: Bringing in a load of hay at harvest time in the province of Ostergötland, south eastern Sweden. Right: A Swedish woman making a band of lace.*

Russia ceding most of Finland and the Åland Islands and with Prince by which a pro Napoleonic policy was adopted. Charles XIII was childless and hoping to conciliate Napoleon the Riksdag chose as crown prince Marshal Jean Baptiste Jules Bernadotte (qv), Prince of Pontecorvo and one of Napoleon's generals. The marshal accepted, and an act of settlement fixing the succession in the Bernadotte dynasty, was enacted in 1810. Bernadotte almost immediately became the dominant influence in Swedish policy. Withdrawing his allegiance from France, he fought with the coalition against Napoleon in 1813-14. In the latter year Denmark was forced to yield Norway to Sweden, receiving in exchange the Swedish possessions in Pomerania. At the end of the Napoleonic Wars Sweden possessed no more territory in Germany. The Congress of Vienna, in 1815, recognized the union of Norway with Sweden.

In 1818 Bernadotte succeeded to the throne as Charles XIV John. Though his reign (1818-44) was characterized by a domestic conflict for control between the throne



and the Riksdag, and, as a foreigner, he was not popular, he was an able administrator and the united kingdoms of Norway and Sweden made considerable progress, materially, politically, and culturally. His successors, Oscar I, Charles XV, and Oscar II (qv), were accepted as Swedes. Between 1864 and 1866 the constitution was ma-



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**THE SWEDISH FISHING INDUSTRY** *Top Fishing cutter on the west coast Bottom, left On board a fishing boat, emptying a net of its catch Bottom, right A Swedish fisherman*





American Swedish News Exchange

**THE SWEDISH LUMBER INDUSTRY.** *Top, left: Logs floating down river to sawmills along north-eastern coast. Top, right: Log wood-pulp factory Bottom: In the sawmill at Skutskär.*



American Swedish News Exchange

*Derrick in the Boliden mine northern Sweden source of iron gold copper and arsenic*

terially revised the Riksdag becoming a bicameral parliament in substantially its present form. The union with Norway began to show strain in the late 19th century and in June, 1905, the Norwegian legislature proclaimed the dissolution of the union, an act ratified without strong opposition by the Swedish Riksdag. During the reign of Oscar II (1872-1907) notable progress was made in social legislation including factory laws, accident insurance for workers and limitation of working hours for women and children. In 1907 Gustavus V (qv) succeeded to the throne and two years later constitutional amendments extended the voting franchise and introduced proportional representation as well as other reforms.

In 1914, at the beginning of World War I, Sweden declared its neutrality and subsequently entered an agreement with Norway and Denmark to defend the neutrality and protect the common economic interests of the Scandinavian countries. Sweden joined the League of Nations in 1920. In 1919 additional social legislation was introduced including the eight hour working day and universal suffrage. This extension of the vote gave greatly increased power to the organized industrial workers. Led by the great Swedish statesman, Karl Hjalmar Branting, the Social Democratic Party became the leading force in Swedish politics. Socialist

governments remained in power until 1928 enacting social reforms which made Sweden prominent in this regard. The Conservative Party was brought into office in 1928 but the coming of the world wide economic and industrial depression shortly afterward restored the Socialists to office in 1932.

In the late 1930s when war seemed imminent in Europe military preparedness and national defense became a paramount question. The Swedish government proclaimed neutrality on the outbreak of World War II. When in November 1939 the Soviet Union invaded Finland Sweden adopted a policy of nonintervention. However the government granted the beleaguered Finns considerable economic and material aid. In December Socialist Premier Per Albin Hansson (1885-1946) brought members of the opposition parties into his cabinet forming a government of national union. Sweden mobilized following the German occupation (April 1940) of Norway and Denmark but Germany made no attempt to invade the country. Despite frequent border incidents and Nazi attacks on Swedish shipping Sweden maintained its neutral status throughout the war.

In July, 1945 after the close of hostilities in Europe, the coalition cabinet resigned and the Social Democrats resumed full control of the government. Bilateral trade pacts were arranged during 1945 with a number of coun-

tries, including Poland and Argentina. Norway, Denmark, and Finland were granted substantial reconstruction credits. The Social Democratic leader Tage Erlander (1901– ) succeeded to the premiership in October, 1946, after the death of Premier Hansson. Sweden and the Soviet Union concluded a five-year commercial agreement the same month. The agreement contained provisions for credits to the Soviet Union totaling \$270 million. In November Sweden became the 54th member of the United Nations.

The Swedish economy, which had flourished in the immediate postwar period, suffered serious reverses during 1947, mainly as the result of an imbalance of imports over exports, a growing shortage of U.S. dollars, and a severe drought. Between January and October national gold and foreign-exchange reserves dropped from 1600 million kronor to 300 million kronor. To meet the crisis the government instituted (October) a drastic emergency program with such measures as curtailment of imports and seizure of Swedish nationals' assets in "hard-currency" countries. Economic conditions improved steadily during 1948.

Sweden maintained a neutral attitude toward the postwar diplomatic struggle between the Soviet bloc of states and the Western democracies. With the other West European nations the country joined (1948) the U.S.-sponsored European Recovery Program, however. On the other hand, the government refused to become a signatory of the North Atlantic Treaty (q.v.), concluded in 1949. Failing in efforts to form a Scandinavian defense bloc without ties to East or West, Sweden began systematically to strengthen its defenses.

Swedish-Soviet relations deteriorated after the spring of 1950, when Soviet naval craft seized a number of Swedish fishing vessels which had allegedly encroached on restricted waters off the Soviet Baltic coast. The tension between the two countries was aggravated in consequence of the exposure (1951–52) of a Soviet espionage ring in Sweden and the destruction (1952) of two Swedish aircraft over the Baltic Sea by the Soviet Air Force.

Important domestic events in Sweden, meanwhile, were the death (1950) of King Gustav V, the accession of his oldest son as Gustav VI, the creation (1951) of a Social Democratic-Agrarian coalition government, and the development (1951–52) of strong inflationary pressures in the Swedish economy. In July, 1953, following the signing of the armistice in Korea, Sweden joined both the Neutral Nations Repatriation Commission

and the Neutral Nations Supervisory Commission.

**SWEDENBORG, EMANUEL** (1688–1772), Swedish scientist and theologian, born in Stockholm. In 1734 he published, in three folios, *Opera Philosophica et Mineralia*, which was followed by *Philosophical Argument on the Infinite, and the Final Cause of Creation; and on the Mechanism of the Operation of Soul and Body*, carrying the doctrine of the *Principia* into higher regions. Dissatisfied with his conclusion, he determined to track the soul further in its relation to the body, and his studies in physiology with this end in view were embodied in *Economy of the Animal Kingdom* (2 vols., 1741) and his *Animal Kingdom* (3 vols. unfinished, 1744–45). At this point his course as a natural philosopher was arrested, and he proceeded to enjoy free access to the spiritual world. In 1749 he made his first public utterance in his new character in the issue in London of the *Heavenly Arcana* (8 vols., 1749–56).

Swedenborg's other notable works (all first published in Latin) are *Heaven and Hell*, *The New Jerusalem and Its Heavenly Doctrine*, *Angelic Wisdom concerning the Divine Love and the Divine Wisdom*, *Angelic Wisdom concerning the Divine Providence*, *The Apocalypse Revealed*, and *The Delights of Wisdom concerning Conjugal Love*.

The distinctive principle of Swedenborgian theology, next to the doctrine of the Divine Humanity, is the doctrine of life. God alone lives. Creation is dead—man is dead, and their apparent life is in the Divine presence.

**SWEDENBORGIAN.** The Swedenborgians, properly "The New Church signified by the New Jerusalem in the Revelation"—were first organized as a distinct denomination in 1788 by Robert Hindmarsh (1759–1835), an English printer, and the church accepted Swedenborg's theological writings as containing a revelation from heaven. Its registered members in Britain now number about 6700 divided among 75 societies.

In America there are two general organizations of those who accept the testimony of Swedenborg. One, "The General Convention of the New Jerusalem", dating from 1817, has about 85 churches and 6000 members, while the other, the "General Church of the New Jerusalem", has about 12 societies and a membership of about 1600. There is a Swedenborg Society in London,



American-Swedish News Exchange  
Selma Lagerlöf, Swedish writer

established in 1810, for printing and publishing Swedenborg's works

#### SWEDISH LANGUAGE AND LITERATURE.

**Language.** Swedish belongs to the northern branch of the Germanic family, within which it is an eastern development of the old *Dönsk tunga*, or Danish tongue,\* a name anciently applied to the language spoken not in Denmark only but in the rest of Scandinavia. The Swedish branch of this tongue that developed from 900 to 1500 is called Old Swedish. Until after 1200 the only records are runic inscriptions, cut chiefly on gravestones. Use of the Latin alphabet began in the 13th century, and there followed periods of differentiation and approximation to Danish. Aside from divergencies of vocabulary, Swedish now differs from Danish especially in its retention, after a vowel, of the old voiceless consonants, *k*, *t*, and *p*, which in Danish changed to *g*, *d*, and *b*, and in its retention of the vowels *a* and *o* in unstressed syllables, whereas Danish has *e* or no vowel.

The main body of the Swedish vocabulary is old Germanic stock, the principal foreign ingredients being Latin and Greek words that came with Christianity or with the growth of scholarship, Low German

words dating from the time of the Hanseatic League, German words from about 1620, and French words borrowed in the 17th and 18th centuries. Swedish has a peculiar accent, which involves both stress and variations of musical pitch. Not only pronunciation but meaning often depends on the exact modulation of a word's musical accent.

**Literature.** The earliest Swedish writings handed down in the Latin alphabet are codes of provincial laws (*landskapslagar*), with which may be classed Magnus Eriksson's *Landslag*, the king's common law for all the provinces under his rule (14th century). To the period of the latter belong the writings of St. Birgitta, a nun and mystic revealer of heavenly things. The ballad-making period in Sweden was chiefly in the 13th and 14th centuries, though the extant collections are of the 16th and 17th centuries. The Reformation transferred the literary center from Vadstena to Uppsala, and the literature of the 16th century is nearly all religious, the chief writers being the brothers Petri, Carmelite monks who had been converted to Lutherism at Wittenberg. The 17th century marked the advent of Stiernhielm (1598-1672), the father of Swedish poetry, and other poets such as Columbus (1642-79), Rosenhane (1619-94) and Johansson, called Lucidor (d. 1684).

In the ensuing epoch (1730-72) the great Swedish names are Swedenborg (1688-1772) and Linnæus (1707-78), belonging respectively to religion and science. In belles-lettres the leader was the poet and prose writer Dalin (1708-63), founder of the *Swedish Argus*, in imitation of the *Spectator*. Other writers of this time reflect the influence of English contemporaries. The Gustavian epoch (1772-1809) is marked by royal patronage of letters, Gustavus III, himself a playwright and orator, assembling an academic court of talent. Leading Gustavians were the poets Kellgren (1751-95), Leopold (1756-1829), and Oxenstierna (1750-1818), while their contemporaries included Fru Lenngren (1754-1817), famed for her idylls and satires, and the poets Bellman (1740-95) and Franzén (1772-1847). The renaissance of national feeling in the 19th century brought into prominence such writers as Geijer (1783-1847) and Tegnér (1782-1846), the latter famous for his *Frithiof's Saga*.

Later names are those of Frederika Bremer (1801-65), Runeberg (1804-77), and Rydberg (1828-95), translator of *Faust*,

these leading to the pre-eminent Strindberg (1849-1912). Contemporaries of the latter include Anne C. Leffler (1849-92) and Geijerstam (1859-1909). In opposition to the realism of Strindberg are the works of Heidenstam (1859-1940), winner of the Nobel Prize in 1916, Levertin (1862-1906), and Selma Lagerlöf (1858-1940), winner of the Nobel Prize in 1909; among the works of the last-named are the Löwensköld series, including *Charlotte Löwensköld* (1926). Other notable names in the modern group are those of Per Hallström (1866- ), novelist and dramatist, Hjalmar Söderberg (1869-1941), and Henning Berger (d.1924), of whom the last-named treated the emigrant to America in several of his stories.

**SWEELINCK or SWELINCK, JAN PIETERS**, also known as JAN PIETERSZON (1562-1621), Dutch organist and composer, born in Amsterdam, and trained by the Italian composer Giuseppe Zarlino (1517-90) in Venice. At the age of nineteen he succeeded his father as organist of the Old Church at Amsterdam, a post he held until his death. Sweelinck exerted considerable influence as a teacher, and was the founder of a famous 17th-century school of German organists. His most notable contribution to musical composition was his development of the organ fugue (q.v.). He established a fugue form characterized by the use of a single theme to which several counterthemes are added gradually; this form was adopted and brought to perfection by the great 18th-century master of contrapuntal music, Johann Sebastian Bach (q.v.). Sweelinck's works include many compositions for the organ, settings for chorus of all the Psalms of David, and number of secular and sacred songs.

**SWEENEY, THOMAS WILLIAM** (1820-92), American soldier, born in Cork, Ireland. He served under General Scott in Mexico, and at the outbreak of the Civil War was in command of the arsenal at St. Louis, Mo. He assisted in the capture of Camp Jackson (1861) and in the organization of the Home Guards, and commanded the Fifty-second Illinois at Fort Donelson. He served at Shiloh and in the Atlanta campaign, and in 1866 took part in the Fenian invasion of Canada. He retired from the army in 1870, with the rank of brigadier general.

**SWEEPSOP**, common name for *Annona squamosa*, a small deciduous tree of the family Annonaceae, native of tropical America and introduced in other warm countries.

The scaly greenish fruit has a soft, somewhat mealy, sweet, and luscious pulp with a musky aromatic odor and flavor. It is much used, generally raw, but sometimes cooked. Other species of *Annona* yield edible fruits, as the soursop, *A. muricata*; the custard apple, *A. reticulata*; the cherimoyer or cherimoya, *A. cherimolia*; and the pond apple, *A. glabra*.

**SWEEPSTAKES**, the total amount of money staked or wagered on a sporting or other event, especially a horse race, from which amount prizes are awarded to certain bettors according to previously fixed rules. The most common form of sweepstakes are on horse races. In this type of sweepstakes, after all the money has been wagered, a drawing is usually made in the following manner: out of a drum containing slips bearing the names of the horses entered in the race, the name of a horse is drawn; then out of another drum containing the stubs of tickets bearing the name and address of the individual bettors, a bettor's name is drawn. Sometimes several names of ticket holders are drawn to the name of one horse. Prizes are awarded those bettors whose horse runs first, second, or third in the race; and often also to bettors who draw the name of any horse in the race. The best-known sweepstakes of recent times are the four conducted annually by the Irish Hospitals Sweepstakes on the running of the English Derby at Epsom, the English Grand National Steeplechase at Aintree, and two other races. Tickets are sold by salesmen who keep a part of their receipts as commission and return the remainder to the operators of the sweepstakes. The money remaining after all prizes and other payments have been made is used to support Irish hospitals. The odds against winning a first prize in the Irish Sweeps (\$100,000) have been calculated to be approximately 400,000 to 1. Sweepstakes, which are a form of lottery (q.v.), are illegal in the United States.

**SWEET, HENRY** (1845-1912), English philologist, born in London. He devoted himself principally to Anglo-Saxon and phonetics. He was the founder and leading spirit of the English school of phonetics, and also made researches into Arabic and Chinese.

**SWEET, OWEN JAY** (1844?-1931), American soldier, born in Kent, Conn. He enlisted when seventeen, and became captain in the Army of the Potomac. He was wounded at Gettysburg, took part in the

battles of Chancellorsville and Fredericksburg, and gained distinction on the march through Georgia with Sherman. After the Civil War he entered the regular army, took part in Indian campaigns, and, being promoted major, served in the Philippines, where in 1900 he became governor of the Third Military District. Returning to the United States in 1904, he had charge of the Department of Dakota, while afterward he served at Matanzas, Cuba. He retired (1909) with the rank of brigadier general.

**SWEET BAY.** See LAUREL.

**SWEETBREAD,** the pancreas or the thymus gland of a calf or other animal, when used as food.

**SWEETBRIER.** See ROSE.

**SWEET CICELY,** or SWEET-SCENTED CHERVIL, common name applied to several perennial herbs belonging to the Parsley family, Umbelliferae. The sweet cicely of Europe, *Myrrhis odorata*, is a graceful, hardy plant which reaches a height of 3 feet and is commonly found along the banks of streams. The small, white, fragrant flowers, arranged in compound umbels, consist of a five-toothed calyx, five petals, five stamens, and a solitary pistil. The fruit consists of two, dry, seedlike carpels. *Myrrhis* is cultivated throughout Europe for its pleasing scent, and its aromatic, sweet-flavored, gray-green leaves are used to flavor soups and salads. The American sweet cicelies comprise the genus *Osmorhiza*, found in moist and woody areas throughout many parts of the United States and Canada. *O. longistylis*, the most typical species of *Osmorhiza*, is found abundantly in eastern U.S. Other varieties include *O. claytonia* of Quebec, Ontario, and midwestern U.S.; *O. obtusa* abundant in New Mexico and Arizona; *O. nuda*, a slender species found throughout California; and *O. occidentalis*, a stout variety which grows throughout western U.S.

**SWEET FERN.** See SWEET GALE.

**SWEET FLAG.** See ACORUS.

**SWEET GALE** or **GALE**, common name for small trees or shrubs of the family Myricaceae comprising the genus *Myrica*, and characterized by their serrate, bitter, fragrant leaves. The solitary flowers, which are borne on short catkins, may have stamens or pistils or both, but never sepals or petals. Fertile catkins are ovoid or globular, sterile catkins are cylindrical or ellipsoid. The fruit is a small, globular, drupelike nut coated with wax or resinous grains. Sweet gale, *M. gale*, also known as bog myrtle, Dutch

myrtle, or sweet willow, has catkins which appear before the leaf buds open. Sweet gale is native to swamps and pond borders throughout North America and Eurasia, and is cultivated throughout N. United States. Its leaves are used in making a sweet herb tea. Sweet fern, *M. asplenifolia*, is a small shrub with fernlike, sweet-scented leaves which give off a sweet, haylike odor when crushed. Sweet fern, rich in tannin, is used in medicine as an astringent. The bayberries or wax myrtles are closely related species in the sweet gale genus; see BAYBERRY.

**SWEET GRASS,** any one of the manna grasses, especially the floating manna grass. *Savastana odorata* is used by the northeastern Indians for basketry.

**SWEET GUM.** See LIQUIDAMBAR.

**SWEET LOCUST.** See HONEY LOCUST.

**SWEET PEA.** See LATHYRUS.

**SWEET POTATO**, common name applied to a perennial, trailing herb, *Ipomoea batatas*, belonging to the Convolvulus, or Morning-Glory, family. The plant, which is native to tropical America, is cultivated on sandy or loamy soils throughout many warm regions of the world, and exists as an important food staple in southern United States. It is planted primarily for its thick, edible root tubers, called sweet potatoes, which are a popular table vegetable. Flowers and fruits are rarely produced.

The sweet potato is grown from slips or cuttings. In the latter instance, roots are bedded to produce slips to cover approximately one eighth of the planting area. Cuttings from vines produced by these slips are used to plant the remainder of the field. Slip propagation is used mainly in the few northern sweet-potato sections to provide the current crop, and vine cuttings are used to produce the seed crop for the next season. In order to prevent the prostrate vines from taking root, they are lifted off the ground and shifted every few weeks. After harvesting, the root tubers are allowed to dry in the sun and are then carefully stored under conditions of dry atmosphere and uniform temperature.

Two principal types of sweet potato are commonly cultivated. The dry, mealy type, a favorite in northern markets, is a yellow sweet potato represented by several varieties, the best known of which are Big-Stem Jersey, Yellow Jersey, and Gold Skin. The southern markets favor a soft, light to deep yellow, moist-fleshed type, represented mainly by the Porto Rico, Nancy Hall, Dooley,

Pumpkin, Yam, and Southern Queen. *Ipomoea pandurata*, often called wild sweet-potato vine, manroot, or man-of-the-earth, is not edible, but is often cultivated as an ornamental vine in eastern United States.

Diseases which commonly attack the sweet potato during growth include the stem rot, black rot, foot rot, and root rot, caused by fungi of the genus *Fusarium*. Control measures for these diseases consist of: crop rotation, in which a new crop is planted as far as possible from the sweet potato field of the preceding year; the use of carefully tilled plant beds; and careful seed selection. Storage diseases such as soft rot, caused by the fungus *Rhizopus nigricans*, are eliminated by maintaining sanitary storage houses and by keeping injured sweet potatoes out of storage. In the Gulf Coast States, the menace of sweet-potato root weevils, blister beetles, leaf hoppers, and aphids to sweet potatoes in the field has been reduced by removing plant rubble from fields after harvest, leaving the insects nothing on which to live during winter.

Sweet potato yields an important starch used commercially for sizing textiles and papers, for the manufacture of adhesives, and in laundries. In the United States, large quantities of sweet potatoes, either freshly harvested or shredded and dried, are used as feed for livestock.

**SWEET SPIRE.** See **LILA**.

**SWEETWATER**, a town of Monroe Co., Tenn., situated about 50 m. by rail s.w. of Knoxville. The town, which lies in the scenic Sweetwater Valley, is a center for sports, especially wild-boar hunting. Nearby are the Cherokee National Forest, and Watts Bar Dam reservoir, providing excellent facilities for fishing. The principal industry in the town and vicinity is the manufacture of textiles. Sweetwater is the site of the Tennessee Military Institute. Pop. (1950) 4199.

**SWEETWATER**, county seat of Nolan Co., Tex., situated 41 miles w. of Abilene. It is served by two railroads. The city is the trading, shipping, and distributing center of a rich stock-raising and mineral-producing region. Beef cattle, hogs, sheep, goats, horses, poultry, dairy products, cotton, corn, and grains are the principal agricultural products of the surrounding area, and oil, natural gas, and gypsum are the chief mineral products. Among the industrial establishments in the city are railroad shops, oil refineries, a gypsum-products plant, meat-packing plants, cotton gins, cottonseed-oil mills, cotton com-

presses, creameries, chicken hatcheries, and factories producing agricultural machinery and building material. Sweetwater is the site of a large annual livestock show. The city was founded in 1882 and chartered in 1897. Pop. (1950) 13,619.

**SWELL.** See **ORGAN**.

**SWELLFISH.** See **GLOBEFISH**.

**SWELL SHARK**, small, voracious gray shark, *U. ullus uter*, of the family Scylliidae, common on the Pacific coast from central California to Chile, and often taken in lobster pots. When caught it will inflate its stomach with air, until its thickness is equal to a third of its length, and will float belly upward until it supposes the danger past.

**SWETTENHAM**, the name of two British colonial administrators, who were brothers. 1. **SIR ALEXANDER** (1846-1933). He served in the British civil service in the colony of Ceylon (1868-84), and was auditor general of Ceylon (1891-95). Subsequently he was acting governor of the Straits Settlements and captain general and governor in chief of Jamaica. 2. **SIR FRANK ATHELSTANE** (1850-1946), born in Belper, Derbyshire. At the age of twenty he entered the British civil service of the Straits Settlements. Subsequently he was resident general (1896-1901) in the Federated Malay States; and governor and commander in chief (1901-04) of the Straits Settlements. He was the author of a number of books on Malay geography, life, and language, including *Malay-English Vocabulary* (1880), *Malay Sketches* (1895), *The Real Malay* (1899), and *British Malaya* (1906); and of other works, including *Unaddressed Letters* (1908) and *Arabella in Africa* (1925).

**SWEYN, SVEN, or SVEND** (d. 1014), King of Denmark (985?-1014). He made an expedition against England in 982 and entered that country again in 994. After succeeding to the Danish throne he led a further invasion of England with the object of effecting a permanent conquest. The submission of the Lancashire, the flight of Ethelred to Normandy, and the submission of the West Saxons made him practically ruler of England (1013), and the next year, following his death, the throne of England passed to his son, Canute.

**SWIETEN, GERARD VAN** (1700-72), Dutch physician and scholar, born in Leyden. After studying philosophy at Louvain, he studied medicine under Hermann Boerhaave, whose most distinguished pupil he became. Called to Vienna in 1745 as physician in ordinary

to the empress Maria Theresa, he instilled new life into every branch of science, but especially promoted reforms in the study of medicine, which, as director of the faculty, he raised to a high standard. Reforms in the other faculties presently followed. He became custodian of the imperial library. In science he sought his fame as an expositor of his teacher Boerhaave. In 1758 Van Swieten, having saved the life of the empress, was created a baron. His observations on military hygiene were expressed in his *Kurze Beschreibung und Heilungsart der Krankheiten welche am Öftesten in dem Feldlager Beobachtet Werden*. His *Commentaria in Hermanni Boerhaave Aphorismos de Cognoscendis et Curandis Morbis* (1741-42) hold a permanent place in medical literature.

His son GOTTFRED (1753-1803) succeeded him as custodian of the imperial library and was an intimate friend of Haydn and Mozart. For the former he adapted the text of the *Creation* from the English and wrote the text of *The Seasons*.

**SWIETENIA.** See MAHOGANY.

**SWIFT**, common name applied to any of the numerous picarian birds belonging to the family Micropodidae, and closely allied to the hummingbird (q.v.). The swift is one of the speediest birds known, and superficially resembles the swallow (q.v.). It has a short bill, a wide, gaping mouth, small, weak feet, and a short, usually forked tail. The long, slender, crescent-shaped wings, when outstretched, give the bird the silhouette of a bow and arrow. The body is sooty-black, with a grayish-white chin patch. Swifts nest along vertical surfaces of old buildings, cliffs, and quarries, building their nests of small twigs, rootlets, feathers, vegetable fibers, and pieces of grass pasted together with a sticky, cementlike substance secreted from their own salivary glands. Some species fashion their nests entirely of this secretion, forming the accumulation which is used in oriental countries to make bird's nest soup; see NEST BUILDING. Birds of both sexes search for food, mostly insects and grain, immediately after nightfall and immediately before sunrise. The female lays from one to six pure white, unspotted eggs in a clutch.

The swifts include approximately 150 species distributed throughout the world and concentrated primarily in tropical regions. The common American swift, *Chaetura pelagica*, often called the chimney swift or chimney swallow, ranges throughout the eastern part of North America, and is noted

for its shrieking calls as it zig-zags through the air at great speeds. It nests in a shallow bracket of saliva-fastened twigs fastened to the inside of a chimney, hollow tree, or cliff, and feeds on numerous flying insects which it captures on the wing. Adult birds of both sexes are colored sooty-brown above and are lighter beneath, the neck is much paler than the rest of the underside. Swifts usually attain a length of 5½ inches, the tail terminating in a series of sharp, rigid spines.

The European swift, *Micropus apus*, is similar in appearance to the chimney swift, and is found nesting in old buildings throughout southern Europe. Vaux's swift, *Chaetura vauxi*, is a somewhat smaller, dark-brown species, and is widely distributed from the Pacific coast of America to Arizona and Montana. The edible-bird's nest swift, or salangane, *Collocalia fuciphaga*, is found in caves throughout S. India, China, and Madagascar.

**SWIFT**, in herpetology, the common name applied to any of several extremely agile, nonpoisonous lizards constituting the genera *Sceloporus* and *Uta* of the suborder Sauria found abundantly in W. North America, Mexico, and Central America. Swifts live mostly on rocky ground or among fallen trees; there they can dart easily behind objects to avoid detection or capture. They are not dangerous to man, and always prefer to run from rather than face attempted capture. Their diet consists mainly of insects and sometimes smaller lizards. They also make rapid attacks upon the nests of small birds, devouring the birds or their eggs. Most swifts attain a length of 8 inches, including the long, slender tail; the males are marked by brilliant patches of blue or green on the throat and abdomen.

The small-scaled swifts, comprising the genus *Uta*, are commonly found in the desert regions of Nevada and Arizona. They usually range in color from dull gray to brown, and have a stout, flattened body almost entirely covered with very fine scales. The three-barred swift, *U. thalassina*, is the handsomest and largest of the twenty known species. It is brilliant, dark green above, and occasionally reaches a length of 2 feet. The forward portion of the back is marked by three sooty black bars. A smaller species, *U. stansburiana*, commonly called Stansbury's swift, found abundantly throughout the Colorado Desert, reaches a length of 5 inches. It is dark gray or green, and is characterized by numerous dark, rounded blotches sur-



rounded by bluish dots. The white-bellied swift, *U. ornata*, differs from most other swifts in having several rows of greatly enlarged scales along the middle of the back. The throat is usually vivid orange yellow.

The spiny swifts, comprising the genus *Sceloporous*, consist of twenty-two species common to Mexico, Central America, and the United States. They are usually dull brown or gray above, and are covered with darker patterns of cross bands. The abdomen and chin of the male are patched with brilliant blue and green. The overlapping dorsal scales are large and pointed, and present a curling, bristling effect. Clark's swift, *S. clarkii*, common to the desert regions of southwest U.S., is a dull-gray species which develops green spots when exposed to the sunlight. It usually attains a length of 10 inches. The collared swift or porcupine lizard, *S. torquatus*, is a large, 15-inch species native to Mexico, Arizona, and Texas. It is greenish gray above, and is characterized by a broad, black, yellow-bordered collar. See also FENCE LIZARD. Compare ALLIGATOR LIZARD.

**SWIFT, EDWIN CHARLES** (d. 1906), American merchant, born in Sandwich, Cape Cod, Mass. About 1875, with his elder brother Gustavus F. Swift, he went to Chicago, where the packing firm of Swift & Company was founded. Edwin Swift was vice-president of the company from 1885 to 1903, and on the death of his brother became chairman of the board of directors.

**SWIFT, GUSTAVUS FRANKLIN** (1839-1903), American merchant, born in Cape Cod, Mass. He engaged in meat packing in Chicago, and was the first to ship meat long distances successfully. He founded and was president of the corporation of Swift & Company, one of the largest packing firms in the United States, and was a prominent member of many other similar concerns. His business enterprise did much for the trade development of Chicago.

**SWIFT, JONATHAN** (1667-1745), English satirist and political pamphleteer, born in Dublin, Ireland, and educated at Trinity College in that city. He journeyed to England in 1688, and obtained employment in the following year as secretary to the diplomat and man of letters Sir William Temple (q.v.). Swift's relations with his employer were not amicable, and in 1694 the young man went back to Ireland, where he took religious orders and was given the small benefice of Kilroot, near Belfast. Growing



Jonathan Swift

restless in his rural isolation, however, he effected a reconciliation with Temple and returned to the latter's household in 1696. There he supervised the education of the beautiful Esther Johnson, daughter of the widowed companion to Lady Gifford, Temple's sister, who lived with Temple on his country estate. Swift remained with Temple until the latter's death in 1699. His stay, though frequently marred by quarrels with his employer, gave him the time for an enormous amount of concentrated reading and for practice in writing.

Swift's first important prose work was *The Battle of the Books* (1697), a brilliant burlesque of the controversy then raging over the relative merits of ancient and modern writers. In this work the author champions the ancients, and, with mordant satire, attacks the pedantry and sham scholarship of his day. In 1699 Swift traveled once more to Ireland, as secretary and chaplain to the Earl of Berkeley. Soon thereafter he began a highly successful career as a political pamphleteer with *A Discourse on the Dissensions in Athens and Rome* (1701), a defense of the statesman John Somers (q.v.) and other Whig (see WHIG AND TORY) members of the House of Lords threatened with impeachment. Swift's *Tale of a Tub*, published in 1704, is the most amusing of his

satirical works, the most strikingly original, and the one in which the full compass of his powers is most perfectly displayed. Here the author ridicules with matchless irony various forms of pretentious pedantry, mainly in literature and religion. The book gave rise, however, to grave doubts concerning Swift's religious orthodoxy, thereby injuring for a time his chances of ecclesiastical preferment.

Though nominally a Whig, Swift differed from his party on many important questions. These differences, together with an inability to gain any substantial advantages from the affiliation, made it easy for him to break from the Whigs. In 1710 a Tory government came to power in Great Britain, and Swift was quickly won over to its ranks. He turned his biting satire against the Whigs in a series of brilliant squibs, assumed the editorship of the *Examiner*, the official Tory publication, and produced a number of independent pamphlets, in all of which he ably defended the policies of the Tory administration. Of these papers the most eloquent and influential was *The Conduct of the Allies* (November, 1711), in which Swift charged that the Whigs had prolonged the War of the Spanish Succession (see SPANISH SUCCESSION, WAR OF THE) out of self-interest. The pamphlet was a major factor in procuring the dismissal of John Churchill (q.v.), first Duke of Marlborough, the commander in chief of the British armies in the War of the Spanish Succession. Swift's *Journal to Stella* (Stella being the private name by which the author designated his former pupil, Esther Johnson, in the series of intimate letters which he addressed to her) was begun in 1710. This work, replete with terms of endearment drawn from the language of the nursery, reveals a curious aspect of the great satirist's enigmatic personality. The only other woman in Swift's life was the beautiful Esther Van Homrigh, daughter of a Dublin merchant of Dutch descent. Miss Van Homrigh (whom Swift referred to as Vanessa), became passionately enamored of him, but he did not return her love.

In 1713, Swift was appointed dean of St. Patrick's Cathedral in Dublin. The following year the Tory administration fell, and Swift's political power was ended. He thereupon retired to Dublin, where he lived until his death. In 1724, Swift created a sensation in Ireland with his *Drapier's Letters*, a series of highly effective pamphlets which secured

the abrogation of the royal patent granted to the English ironmaster William Wood (q.v.) for the coining of copper halfpence in Ireland. The completed manuscript of Swift's masterpiece, *Gulliver's Travels* (q.v.), was published anonymously in 1726, meeting with instantaneous success. This work is an unrivalled satire on the personal, political, and social corruption of mankind.

The last years of Swift were overshadowed by a growing loneliness and dread of insanity. He suffered frequent attacks of vertigo, which culminated in September, 1742, in a paralytic stroke. A period of mental decay closed with his death three years later. He was buried in his own cathedral beside the coffin of Stella. His epitaph, written by him, reads "Here lies the body of Jonathan Swift, D.D., dean of this cathedral, where burning indignation can no longer tear at his heart. Go, traveler, and imitate if you can a man who was an undaunted champion of liberty."

**SWIFT, JOSEPH GARDNER** (1783-1865), American soldier, born in Nantucket, Mass. He served as chief engineer of the army under General Wilkinson in the War of 1812 and later had charge of the construction of the fortifications of New York harbor. He became superintendent of the United States Military Academy (1812-17).

**SWIFT, LEWIS** (1820-1913), American astronomer, born in Clarkson, N.Y. He was noted for his discoveries of comets and nebulae. He became director of the Warner Observatory at Rochester, N.Y., and was awarded the Lalande prize of the Paris Academy and the Jackson Gwilt medal of the Royal Astronomical Society.

**SWIMMING**, the action of self-propulsion on or in water by natural means, as, in the case of man, by strokes of the hands and feet. Man is the only animal that does not swim instinctively. The swimming of quadrupeds amounts simply to walking in the water, whereas man, by reason of his anatomical structure, must develop many strokes besides the "dog-paddle" by which most other land animals propel themselves.

The importance of swimming as an essential part of physical equipment in modern life, not only for its healthful benefits but also for its possible emergency advantages, is becoming recognized more and more by educators. Perhaps the most advanced in this respect are the Scandinavian peoples, who long ago placed compulsory swimming instruction in the curriculum of their educa-

tional systems. We in the United States are profiting by this example to such an extent that in many of our cities, students in public schools may not graduate until they have satisfactorily passed aquatic tests consistent with individual physical equipment. It is only a matter of time before it will be realized that timidity is the only important obstacle to be overcome, and this is no problem whatever provided a child is given proper instruction early in life—the earlier the better. Self-instruction is not to be encouraged because of the tendency to develop improper habits or inefficient methods which, once acquired, are difficult to eradicate.

By learning early in his swimming career to keep his face in the water, a pupil eliminates considerable of the fear prevalent among beginners. One of the most successful means of instilling self-confidence is the use of the *dead man's float*, which consists in lying flat on the surface of the water, legs and arms outstretched, with the face submerged. Once the swimmer acquires the proper body balance, this position can be maintained for long periods. The use of the *dead man's float* is important also in laying the foundation for proper breathing, which consists in so many cases of exhalation under the surface of the water.

The following are the important strokes used in swimming.

**Breast Stroke.** In this stroke the swimmer lies on his stomach with arms stretched straight in front, palms down, and performs the following movements.

(1) Palms of hands are turned slightly outward and arms are swept back in a line with shoulders.

(2) Hands are brought together in front of the chest by dropping the elbows, and at the same time the legs are drawn as far as possible up to the body, knees and toes turned out.

(3) Arms are shot out straight to the starting point as legs are kicked outward as far as possible and then snapped together, straightened out.

**Backstroke.** This stroke employs the same leg movements as does the breast stroke, and this is the only stroke in which the swimmer performs the same movements with legs and arms at the same time.

(1) Hands are drawn up along the body, fingers bent, until they reach the shoulders, with elbows well turned out.

(2) The arms are straightened out horizontally from the shoulders, palms down.

(3) The arms are then brought down sharply to the side of the body.

In both the breast stroke and the backstroke the arms should be kept at all times near the surface of the water but never above it.

**Racing Backstroke.** This stroke is a variation of the backstroke, and consists of an overhead arm movement and a kick similar to that used in the crawl. It is a speedy stroke, but is very tiring except for short distances.

**Side Stroke.** This stroke, employed on either the right or left side, is of particular value in long-distance swimming. For swimming on the right side, the following movements are executed.

(1) Right arm is extended straight in front and left hand is placed at left side. Left arm is drawn slowly up to chest, palm out, and legs are bent back together from the knees.

(2) Left arm is extended forward as far as possible, and left leg is extended backward from the hip as far as possible while right leg is extended forward from the hip as far as possible.

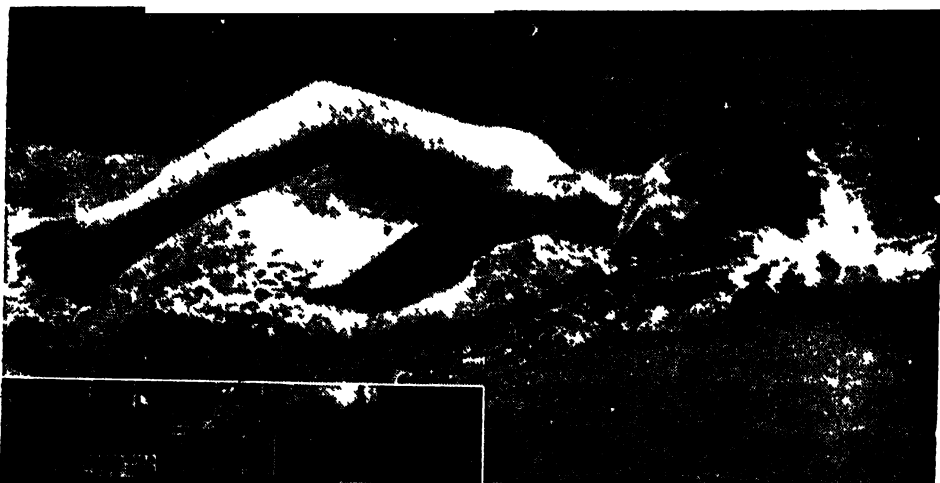
(3) Left arm is drawn down to side of left leg, elbow unbent, and legs are snapped together, straightened out.

The right arm remains extended to help balance the body, or can be extended out from and returned to the right side of the body on movements 1 and 3. The swimmer inhales on movement 3 and exhales on movement 2.

**Single Overhand or Single Overarm Stroke.** This stroke employs a leg kick, known as the scissors kick, used in the side stroke. The under arm is used as in the side stroke, and the upper arm is brought through the water to the upper leg, then raised from the water for the next movement and extended forward away from the head.

**Double Overhand or Double Overarm Stroke.** This stroke combines the scissors leg kick with alternate overhand arm movements. The right arm, bent out, is lifted from the water and straightened as far forward as possible, then drawn down through the water to the right side. The left arm should be in a position to come forward at the final movement of the right. The face is held under water. The swimmer inhales as the left arm passes the mouth and exhales as the right arm comes forward.

**Trudgen Stroke.** This stroke, introduced in England in 1873 by the amateur swim-



Fwing Galloway With Work



SWIMMING Above Inhaling during the crawl stroke Left A Japanese swimmer holds a long lead in qualifying trials for a meet in California Below Women swimmers demonstrate back stroke (top) and breast stroke (bottom)



mer John Trudgen, was considered, until the advent of the crawl stroke (see below), the stroke which gave the swimmer the greatest possible speed. It consists of alternate overhand arm movements and a frog kick similar to that used in the breast stroke.

**Crawl Stroke** This stroke is the fastest swimming stroke evolved to date. As originally introduced, it was a combination of the trudgen arm stroke with a leg drive used by the natives of the South Sea Islands but various details have since been changed to meet the requirements of individual swimmers, so that the present stroke is considerably different from the original. The arm stroke is similar to that used in the trudgen stroke. The leg stroke consists of an alternate up and down kick from the hips with legs relaxed, toes pointed and feet turned

inward. The opening of the feet should be not more than about one foot, and the feet should not be raised out of the water. The speed of the kick ranges from four to eight beats to one arm stroke. The swimmer inhales through the mouth by twisting the body to the side from the waist as the left arm passes his head, and exhales under water as the left arm comes forward for the next drive.

The importance of swimming in connection with physical development and good condition is due to the fact that no other exercise involves so completely the play of so large a number of muscles of the body.

The following are the important world swimming records. For data concerning the swimming of the English Channel see ENGLISH CHANNEL.

## MEN'S FREE STYLE

Distance	Time	Holder	Country	Where Made	Date
100 yds	47	Dick Caveland	U S A	Columbus Ohio	Feb 10 1951
100 meters	55.48	Allen M. Stack	U S A	New Haven Conn	June 29 1948
200 yds	2m 16	John Marshall	Australia	New Haven Conn	March 31 1950
200 meters	2m 55	John Marshall	Australia	New Haven Conn	March 31 1950
300 yds	2m 57.68	Wayne Moore	U S A	Hamilton Bermuda	Aug 6 1951
300 meters	3m 20.28	John Marshall	Australia	New Haven Conn	Feb 11 1950
400 meters	4m 26.98	John Marshall	U S A	New Haven Conn	March 24 1951
410 yds	4m 28.1	John Marshall	U S A	New Haven Conn	March 24 1951
500 yds	5m 12.8	John Marshall	Australia	New Haven Conn	June 30 1950
500 meters	5m 13.78	John Marshall	U S A	New Haven Conn	Feb 17 1951
800 meters	9m 35.58	H. Furushiro	Japan	Los Angeles Calif	Aug 19 1949
880 yds	9m 37.58	John Marshall	Australia	New Haven Conn	Jul 23 1950
1000 yds	11m 37.48	Jac Melica	U S A	Portland Ore	Jul 29 1951
1000 meters	12m 33.88	I. Amato	Japan	Tokyo Japan	Aug 10 1948
1500 meters	18m 18.88	John Marshall	U S A	Austin Tex	May 29 1951
1 mile	19m 49.48	John Marshall	Australia	New Haven Conn	Jul 7 1950

## MEN'S BREAST STROKE

Distance	Time	Holder	Country	Where Made	Date
100 yds	58.58	Keith Carter	U S A	Lafayette La	May 5 1949
100 meters	1m 6.88	I. K. Melnikov	U S S R	Moscow	April 17 1950
200 yds	2m 13.18	Robert Brainer	U S A	Princeton N J	March 11 1950
200 meters	2m 28.38	Joseph Verker	U S A	New Haven Conn	March 31 1950
400 meters	5m 35.48	Robert Brainer	U S A	Princeton N J	Feb 8 1950
500 meters	7m 10.68	Bob Bonte	Netherlands	Amsterdam Neth	Oct 19 1948

## MEN'S BACKSTROKE

Distance	Time	Holder	Country	Where Made	Date
100 yds	56.58	Jackie Taylor	U S A	Columbus Ohio	Feb 10 1951
100 meters	1m 3.68	Allen M. Stack	U S A	New Haven Conn	Feb 4 1949
150 yds	1m 29.98	Allen M. Stack	U S A	New Haven Conn	May 5 1949
200 meters	2m 18.58	Allen M. Stack	U S A	New Haven Conn	May 4 1949
400 meters	5m 3.98	Allen M. Stack	U S A	New Haven Conn	Feb 14 1948

## WOMEN'S FREE STYLE

Distance	Time	Holder	Country	Where Made	Date
100 yds	58.2s	G. Andersen	Denmark	Svendborg, Denmark	Feb. 24 1949
100 meters	1m 4.6s	W. Den Ouden	Netherlands	Amsterdam, Holland	Feb. 27 1936
200 meters	2m 21.7s	R. Hveger	Denmark	Aarhus, Denmark	Sept. 11 1938
220 yds	2m 22.6s	R. Hveger	Denmark	Copenhagen, Denmark	April 23 1939
300 yds	3m 25.6s	R. Hveger	Denmark	Copenhagen, Denmark	Oct. 2 1938
300 meters	3m 42.5s	R. Hveger	Denmark	Copenhagen, Denmark	Sept. 15 1910
400 meters	5m 0.1s	R. Hveger	Denmark	Copenhagen, Denmark	Sept. 15 1910
440 yds	5m 7.9s	Ann Curtis	U.S.A.	Seattle, Wash.	May 2 1947
500 yds	5m 53s	R. Hveger	Denmark	Copenhagen, Denmark	April 19 1912
500 meters	6m 27.4s	R. Hveger	Denmark	Copenhagen, Denmark	Feb. 11 1940
800 meters	10m 52.5s	R. Hveger	Denmark	Copenhagen, Denmark	Aug. 13 1941
840 yds	11m 8.6s	Ann Curtis	U.S.A.	San Francisco, Calif.	July 30 1944
1000 yds	12m 36s	R. Hveger	Denmark	Helsingor, Denmark	Sept. 4 1938
1000 meters	13m 54.4s	R. Hveger	Denmark	Copenhagen, Denmark	Aug. 20 1941
1500 meters	20m 57s	R. Hveger	Denmark	Copenhagen, Denmark	Aug. 20 1941
1 mile	23m 11.5s	R. Hveger	Denmark	Helsingor, Denmark	July 3 1938

## WOMEN'S BREAST STROKE

Distance	Time	Holder	Country	Where Made	Date
100 yds	1m 9.2s	N. van Vliet	Netherlands	Hilversum, Neth.	May 4 1947
100 meters	1m 17.4s	Giselle Valkrey	France	Casablanca, Morocco	April 23 1950
200 yds	2m 35.6s	N. van Vliet	Netherlands	The Hague, Neth.	Aug. 4 1916
200 meters	2m 49.2s	N. van Vliet	Netherlands	Hilversum, Neth.	July 0 1947
400 meters	5m 56.6s	N. van Vliet	Netherlands	Hilversum, Neth.	Nov. 3 1947
500 meters	7m 41s	N. van Vliet	Netherlands	Hilversum, Neth.	Dec. 1 1916

## WOMEN'S BACKSTROKE

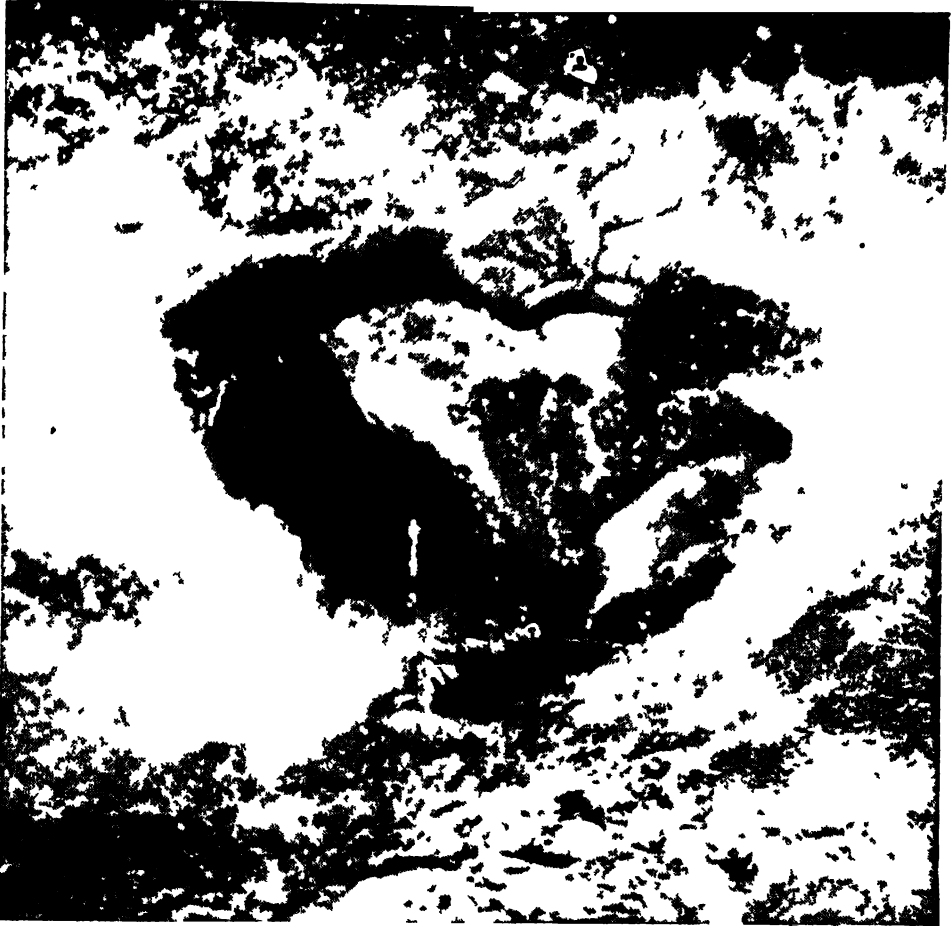
Distance	Time	Holder	Country	Where Made	Date
100 yds	1m 4.6s	C. Wilma	Netherlands	Hilversum, Neth.	March 13 1950
100 meters	1m 10.9s	C. Kruit	Netherlands	Rotterdam, Neth.	Sept. 22 1939
150 yds	1m 47.1s	C. Kruit	Netherlands	Rotterdam, Neth.	Sept. 29 1939
200 meters	2m 45.3s	C. Wilma	Netherlands	Hilversum, Neth.	April 2 1950
400 meters	5m 38.2s	R. Hveger	Denmark	Copenhagen, Denmark	March 2 1941

## OLYMPIC RECORDS—MEN

Distance	Time	Holder	Country	Where Made	Date
100 meter free style	57.3	Walter R.	U.S.A.	Tonlin, England	1948
100 meters free style	1:30.7	Jean Bretteux	France	Helsinki, Finland	1952
1500 meters free style	18m 30	Forl Knino	U.S.A.	Helsinki, Finland	1952
100 meters backstroke	1m 5.4s	Y. Oyikawa	U.S.A.	Helsinki, Finland	1952
200 meters breast stroke	2m 34.4s	John Davis	Australia	Helsinki, Finland	1952

## OLYMPIC RECORDS—WOMEN

Distance	Time	Holder	Country	Where Made	Date
100 meters free style	1m 5.9s	H. Mastenbroek	Netherlands	Berlin, Germany	1936
100 meters free style	5m 12.1s	Valerie Gyenge	Hungary	Helsinki, Finland	1952
100 meters backstroke	1m 14.4s	Karen Harup	Denmark	London, England	1948
200 meters breast stroke	2m 51.7s	Eva Szekely	Hungary	Helsinki, Finland	1952



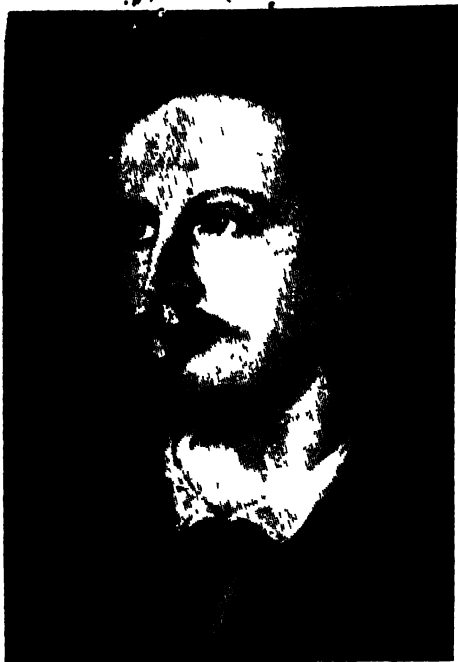
W. W. L. I. T.

*The Yama-hi of Japan* (1909), a novel received in the 400 new style series in 1949.

**SWINBURNE, ALFRED CHAMBERLAIN** (1857-1909), English poet, born in London, educated at Balliol College, Oxford University. During his university days he contributed both verse and prose to *Undergraduate Papers*, a student publication edited by the scholar John Addington Symonds (1854-1900) and wrote the dramas *The Queen Mother* (1880) and *Rosamond* (1880). In 1880 Swinburne left Oxford without taking a degree and became associated with the painter and poet Dante Gabriel Rossetti, a leading figure in the so-called Pre-Raphaelite Brotherhood (see PRE-RAPHAELITES), and with the poet William Morris. He traveled on the Continent in 1864. In 1865 he composed *Atalanta in Calydon*, a lyrical drama notable for the metrical display of its choruses, and

*Chastelard*, a romantic tragedy dealing with the early life of Mary Queen of Scots. The following year he produced *Poems and Ballads*, the unabashedly sensual and pagan spirit of which provoked a storm of criticism. Swinburne defended himself against his literary detractors in *Notes on Poems and Reviews* (1866).

After a meeting with the Italian patriot Giuseppe Mazzini Swinburne wrote *A Song of Lull* (1867) and *Songs before Sunrise* (1871), both militantly republican in tone. He continued his dramatic history of *Mary of Scotland* in *Bothwell* (1874), bringing the series to a close with *Mary Stuart* in 1881. Meanwhile, in 1870, he produced the classical drama *Freuchtheus*, and two years later a second and more conventional collection of



Algernon Charles Swinburne

*Poems and Ballads*. In 1879 Swinburne, his health having become seriously impaired, entered the home of his friend, the English literary critic Walter Theodore Watts-Dunton, at Putney, and there passed the rest of his life. His other notable works of verse include *Songs of the Springtides* (1880), *Studies in Song* (1880), *Tristram of Lyonesse* (1882), *A Century of Roundells* (1883), *A Midsummer Holiday* (1884), *Marino Faliero* (1885), *Lochrine* (1887), *Poems and Ballads* (third series, 1889), *Astrophel* (1894), *A Tale of Balen* (1896), and *A Channel Passage* (1899); his prose works include *Note on Charlotte Brontë* (1877), *Study of Shakespeare* (1880), *Miscellanies* (1886), and *The Age of Shakespeare* (1909).

**SWINDLING.** See THEFT.

**SWINDON**, municipal borough in Wiltshire, England, 77 miles w. of London. The locomotive and carriage works of the Great Western Railway form the town's chief source of revenue. There are also corn and cattle markets. Pop. (1951 prelim.) 68,932.

**SWINE**, common name applied to a group of artiodactyl mammals in the Hog family, Suidae (q.v.), or in the Peccary family, and applied especially to domestic hogs; see Hog.

**SWINEMÜNDE**, a seaport of Poland, situated on Usedom Island, near the de facto Polish-German frontier. The city lies at the mouth of the Swine R., the strait linking the Baltic Sea and Stettiner Haf, which receives the waters of the Oder R. Swinemunde harbor, one of the best on the s. coast of the Baltic Sea, is navigable by ocean-going vessels and is protected by two breakwaters. The town was founded in 1748 and chartered in 1765. Prior to the defeat of Germany in World War II it formed a part of the Prussian province of Pomerania. Under the agreements made at the Potsdam Conference (q.v.), the line demarcating the w. limits of German territory under Polish administration passes immediately to the w. of Swinemunde Pop., about 30,000.

**SWING**, in the idiom of popular music, a term employed to designate jazz which is completely improvised, as distinguished from "straight" jazz, or jazz played wholly or in part from a score or from memory, see Jazz. The verb "to swing" thus signifies the embellishment of a basic melodic line with extemporized variations. In a more restricted sense, swing denotes a dynamic, quasi-inspirational quality in jazz, achieved when jazz musicians, during a so-called "jam session", or period of free improvisation, reach a climax of frenetic excitement. Prior to the establishment of its specialized meaning in jazz, the term "swing" was used to characterize a general lilt and buoyancy in music. Thus, a popular dance tune, introduced in San Francisco, California, in 1911, bore the title of the "Texas Tommy Swing." The specific relation of swing to jazz, however, was not established until about 1934; at that time, so-called "hot" (improvised) jazz attained national popularity in the United States. Many popular tunes purportedly written in the "swing" idiom actually differ in no essential respects from typical compositions in the standard popular jazz repertory. According to exponents, swing is a method of improvisation and rendition, rather than a style of composing, and hence cannot be committed to paper.

**SWING**, DAVID (1830-94), American preacher, born in Cincinnati, Ohio, and educated at Miami University, Oxford, Ohio. From 1853 to 1865 he was professor of languages at Miami University. In 1866 he was called to the Fourth Presbyterian Church in Chicago and soon became one of the prominent clergymen of that city. In 1874 he was tried for heresy and acquitted, but, as





Metronome

SWING MUSIC Josh Whit (guitar) and Benny Goodman (clarinet) at a jam session

the consequence he resigned his pastorate and withdrew from the Presbyterian ministry. Many of his congregation sympathized with him, and a new church was organized meeting at first in a theatre and later in the Central Music Hall where Swingle continued to preach to one of the largest congregations in Chicago till his death. His preaching, though diverging from the verbal standard of orthodoxy, was essentially evangelized and spiritual and marked by intellectual power.

**SWING, RAYMOND GRAM** (1887- ) American journalist and radio commentator born in Cortland, N.Y., and educated at Oberlin College, Ohio. He began his newspaper career in Cleveland, Ohio, 1906, was correspondent for American papers in Berlin, Germany, 1913-17, and 1919-22, in London, 1924-25, and 1926-34. Returning to the United States, he joined the editorial board of *The Nation* in 1934 and later represented the *London News Chronicle*. He started on his broadcasting career in 1935 as news commentator on American affairs for the British Broadcasting Corporation, was with the Columbia Broadcasting System, 1935-36, and then joined the Mutual Broadcasting System. His works include *Forerunners of*

*American Fascism* (1935) and *How War Came* (1940).

**SWINGLE, WALTER TENNYSON** (1871-1951) American agricultural botanist born



Harper &amp; Bros

Raymond Gram Swing



Swiss Federal Railways

*Members of the Swiss Papal Guard in their colorful uniforms*

in Canaan, Pa. From 1902 to 1941 he was a special agent of the U.S. Department of Agriculture. He made possible the cultivation of Smyrna figs in California. He wrote many works on botany matters, and has assisted in building up the large collection of Chinese books in the Library of Congress.

**SWINNERTON, FRANK ARTHUR** (1884– ), British novelist, born in Wood Green, Middlesex. His first book, *The Merry Heart*, appeared in 1909; others include *Sketch of a Sinner* (1929), *Swinerton: An Autobiography* (1937), *Thankless Child* (1942), *Doctor's Wife Comes to Stay* (1950), *Flower for Catherine* (1951), and *An Affair of Love* (1952).

**SWINTON**, manufacturing town of West Riding, Yorkshire, England, 4 miles N.E. of Rotherham. It has railway, iron, glass, and pottery works. Pop. (1951 prelim.) 11,922.

**SWINTON AND PENDLEBURY**, municipal borough of Lancashire, England, 5 miles N.W. of Manchester. Cotton manufacture and brickmaking are its chief industries. Pop. (1951 prelim.) 41,294.

**SWISS FAMILY ROBINSON**, or *ADVENTURES IN A DESERT ISLAND*, English title of imaginative story by the Swiss writer Johann Rudolf Wyss (1781–1830), first published in 1813 in German under the title *Der Schweizerische Robinson*. Like the English classic *Robinson Crusoe* (1719) by Daniel Defoe, which in part inspired Wyss' story, the *Swiss Family Robinson* is written in a style intended to appeal to young persons, both books have been translated into many languages and have had universal appeal for both young and old. The *Swiss Family Robinson* recounts the adventures of a Swiss family, consisting of a clergyman, his wife, and their four sons, who, while on a sea voyage, suffer shipwreck and are then deserted by the Captain and crew of their vessel. After reaching land, the Robinsons discover their haven to be an uninhabited island. There they display remarkable fortitude in the face of adversity and great ingenuity in adapting themselves to their situation. They build a home in a large



SAINT EUSTACH

Abode of the apostle Eustachius on the  
Switzerland Right Angling in the Kander  
River in the Bernese Oberland



to continue to provide themselves with food and other necessities and emerge successfully from all encounters with wild beasts. In the course of several years they create so entirely self-sufficient and idyllic a mode of life that they refuse to leave their island home when a passing vessel affords them the opportunity to return to the civilized world.

**SWISS GUARD**, a celebrated corps or regiment of Swiss mercenaries in the French army of the old regime constituted 'Gardes' by royal decree in 1616. They were unwavering in their fidelity to the Bourbon kings and their courage never faltered when on August 10, 1792, they were called on to defend the palace of the Tuileries against the revolutionists and 500 of their number were slain. Their heroism was commemorated in 1821 by the great lion outside one of the gates of Lucerne cut out of the rock after a model by Thorwaldsen. Another Swiss Guard *Guardia Svizzera* the Papal Guard consists of ten officers and 110 men. Only Swiss can enter it and the privates are not allowed to marry.

**SWISSVALE**, a borough of Allegheny Co., Pa., situated 6 m. by rail S.E. of Pittsburgh. It is an important manufacturing center, containing the largest plant manufacturing railroad signaling devices in the U.S., and factories producing steel, signa glass and

glass making machinery. Swissvale was incorporated as a borough in 1898. Pop. (1950) 16,458.

**SWITHIN**, or **SWITHUN**, St., bishop of Winchester from 852 to 862. According to the 10th century *Lif* attributed to Gotzelm, he was tutor to Eighbert's son Ethelwulf. He was active as a builder of bridges and churches. St. Swithun's Day is July 15. His connection with the still current belief that if rain fall on July 15 it will continue for forty days is probably accidental.

**SWITZERLAND** (Fr. *Suisse*, Ger. *Schweiz*, It. *Svizzera*) a federal republic in western Europe, bounded on the N. by France and Germany, on the E. by Austria and Liechtenstein, and on the S. by Italy, and on the W. by France. Switzerland is a confederation comprising the twenty-two cantons, or States, of Appenzell Aargau, Appenzell Basle, Bern, Fribourg, Glarus, Geneva, Graubünden, Lucerne, Neuchâtel, Saint Gallen, Schaffhausen, Schwyz, Solothurn, Thurgau, Ticino, Unterwalden, Uri, Valais, Vaud, Zug, and Zurich (qq.v.). The

capital of Switzerland is Bern, and the largest city in population is Zurich; other important cities include Basel, Geneva, and Lausanne (q.v.). Area, 15,944 sq.m.; pop. (1950) 4,714,992.

Switzerland is the most mountainous country of Europe, more than 70% of its area being divided between the Alps (q.v.), which extend over the central and s. sections, and the Jura Mts. (q.v.), which cover the n.w. portion of the country. Between the two mountain systems lies the Swiss plateau, about 1300 ft. above sea level in average elevation and 30 m. wide; it extends from the Lake of Geneva (q.v.) in the extreme s.w. to Lake Constance (q.v.) in the extreme n.e. The plateau is itself thickly studded with hills. Between the ranges of the Alps and Jura mountains also stretch long valleys connected by transverse gorges (see ENGADINE). Of the total area of Switzerland, about 6% is arable or cultivated, 46% is grass and pasture land, and 25% is woodland and forest. Nearly every Swiss valley is traversed by streams, often interrupted by picturesque waterfalls, the highest being the Staubbach falls (980 ft.) of the Platschenbach R. in the canton of Bern. The principal river system is formed by the Rhine R. (q.v.) and its tributaries. Other important rivers are the Rhone, Ticino, and Inn (q.v.). The Swiss rivers are not navigable for any appreciable extent. Switzerland is famous for its multitude of lakes, particularly those of the Alpine region, known for their scenic beauty. The most important include the Lake of Geneva, Lake of Constance, Lake of Lugano, and Lake Maggiore, which are not wholly within Swiss borders, and lakes Neuchâtel, Lucerne, Zurich, Brienz, and Thun, which are entirely within Switzerland. Next to timber, water power is the greatest Swiss natural resource, furnishing, in a recent year, 10,271,000,000 kw.hrs. of hydroelectricity. On the plateau and lower valleys a temperate climate prevails, with a mean annual temperature of about 50°F. The temperature varies with the altitude, decreasing about 3° for every additional 1000 ft. of elevation. The limit of grain cultivation is about 4000 ft., and above 8500-9500 ft. is a zone of perpetual snow.

Neither the topography nor the climate is very favorable to agriculture, and Switzerland raises only about a third of its necessary food. The leading crops are wheat, potatoes, fruits (chiefly apples and pears), vegetables, and sugar beets. The chief agri-

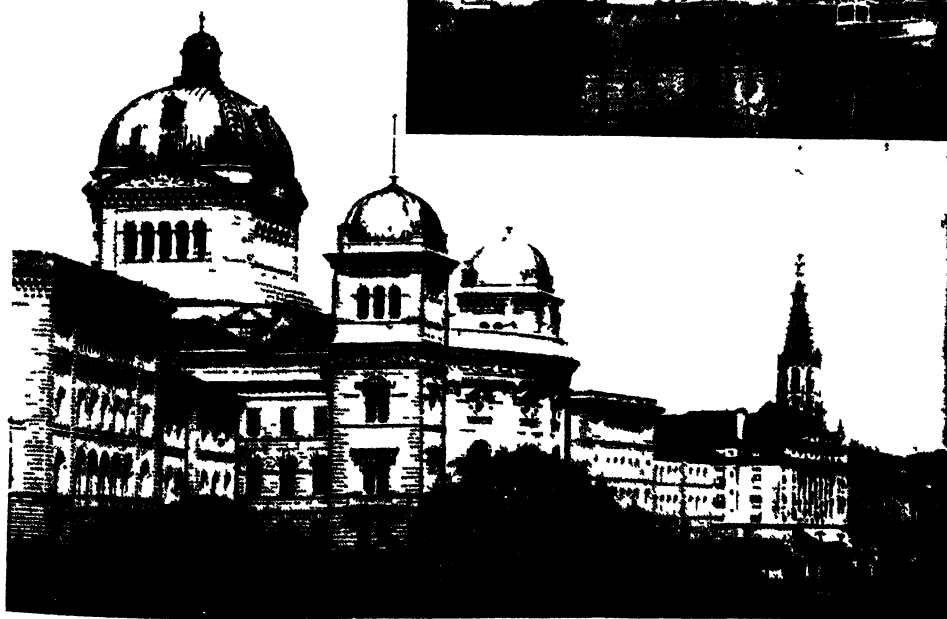
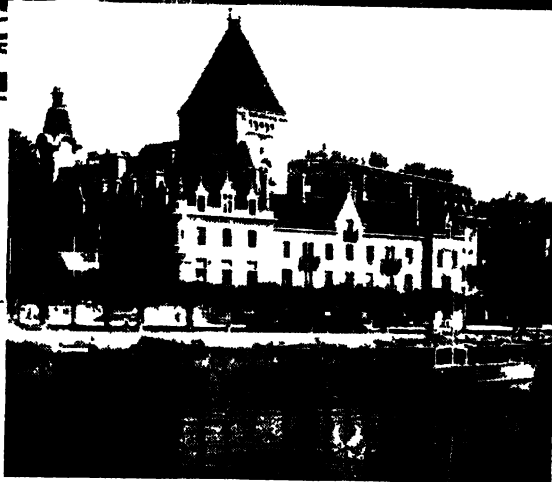
cultural industries are the raising of livestock and dairying; butter, condensed milk, and, particularly, cheeses are the leading products. In a recent year livestock included about 1,607,000 cattle, 892,000 hogs, and over 130,000 horses. The principal manufacturing enterprises produce machinery (notably precision and machine tools), textiles, clothing, chemicals, refined metals, jewelry and watches, foodstuffs, wood products, and paper. The manufacture of wines and beer is also an important industry. The Swiss are noted for their arts and crafts; music boxes, embroideries, laces, and carved objects of wood are among the articles made, many of them in Swiss homes. Swiss manufacturing is chiefly designed for export. In a recent year exports were valued at over 4,690,000,000 Swiss francs; imports, principally raw materials, foodstuffs, and certain manufactured products, were valued at more than 5,915,000,000 Swiss francs. Trade is carried on chiefly with the United States, France, Germany, the United Kingdom, and Italy. The unfavorable balance of trade is covered by so-called invisible exports, notably the tourist trade, one of the leading commercial activities of Switzerland.

Ethnologically, the Swiss represent, to a great degree, an admixture of the Helvetii (q.v.), a Celtic people who inhabited the w. part of modern Switzerland about 100 B.C., and the Rhaetians (see *History* below) with the Teutonic tribes which invaded the west Roman Empire in the early centuries of the Christian era. Large groups of Germans, French, and Italians live in Switzerland; their three languages and Romansch (q.v.), the Swiss language, are official and national languages. Primary education of children is compulsory and free. In a recent year about 430,000 students attended primary schools, and 51,000 attended secondary schools. Seven universities are maintained, by the various cantons, at Basel, Bern, Fribourg, Geneva, Lausanne, Neuchâtel, and Zurich. The cantons also maintain various trade, art, technical, and commercial schools, and at Zurich the federal government maintains an institute of technology. Communications include 3345 m. of railroad, of which 1812 m. are owned and operated by the federal government, and 10,200 m. of main roads. Though Switzerland is landlocked, the Swiss merchant marine, created by decree of the federal government in 1941, consists of about twenty vessels, operating from foreign ports and from the Rhine R. port of Basel.



Swiss Federal Railways

Above: Scene on the Lake of Lucerne, Switzerland Right: Château d'Ouchy at Lausanne, Switzerland Below: View of part of the Federal Palace in Berne.





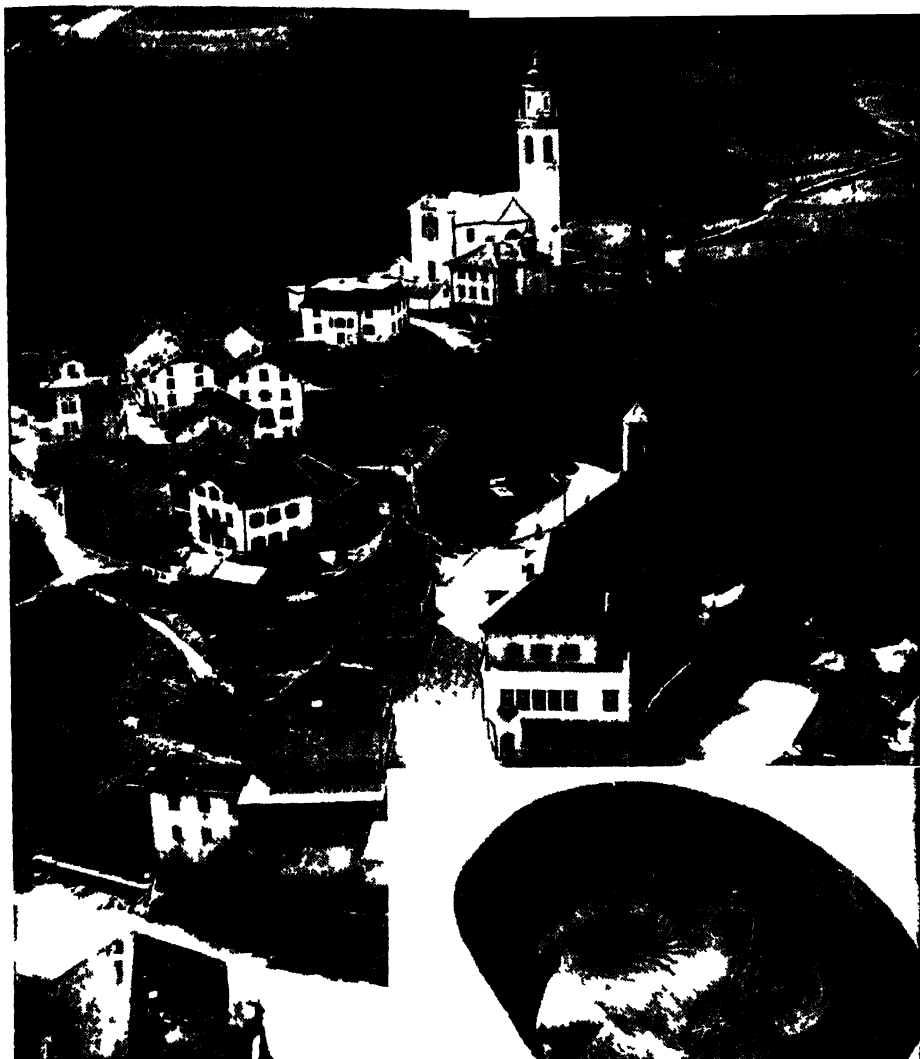
Swiss Federal Railways

*Above: Systematically making hay at Allières, in the canton of Fribourg, Switzerland.*

*Left: Swiss girl carrying a basket of wheat, in the canton of Grisons.*

Three of the twenty-two cantons, Unterwalden, Basel, and Appenzell, are divided into half-cantons for administrative purposes. The Swiss Confederation is governed under a constitution adopted on May 29, 1874, and amended many times thereafter. Every male citizen, on reaching his twentieth birthday, may vote and is eligible for election, though clergymen are not eligible for election to the federal legislature. The Swiss bicameral parliament consists of the *Stände-*

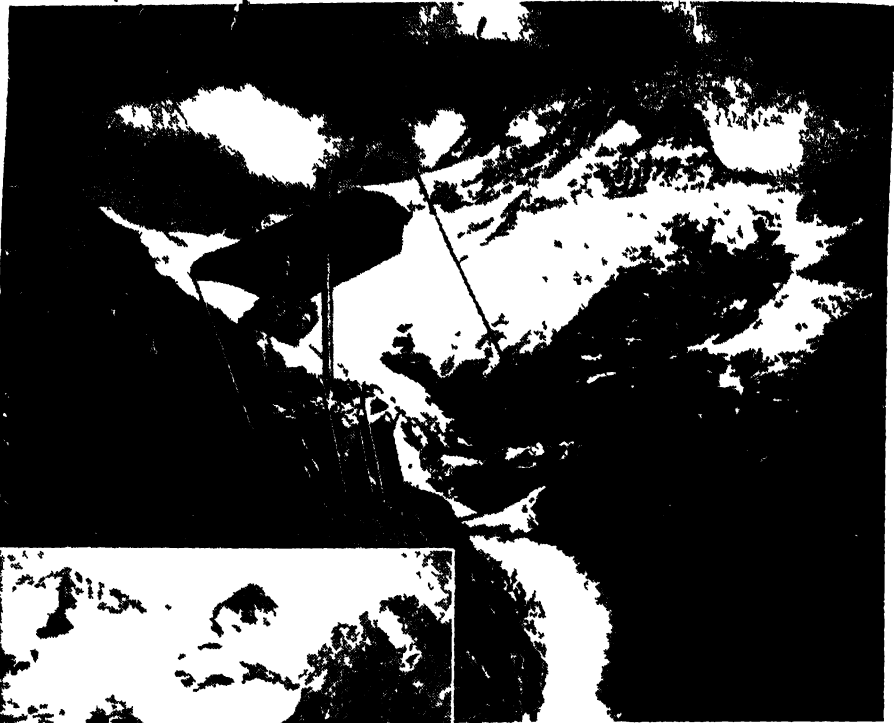
*rat*, or Council of States, with 44 members (2 for each canton) elected for varying periods at the discretion of the canton, and the *Nationalrat*, or National Council, consisting of 196 members elected during general elections on the basis of proportional representation (1 for each 24,000 inhabitants). After each general election, which is held once each four years, the two houses elect, in joint session, the *Bundesrat*, or Federal Council, of 7 members. Of this executive council one member is designated as president and another as vice president, who usually becomes president the following year. The *Bundesrat* is completely responsible to the federal assembly. Popular referendum is an integral part of Swiss government. Constitutional amendments may be initiated by a petition of 50,000 voters and must be ratified by a referendum; ordinary legislation may be made subject to a referendum by a petition of 30,000 voters or the majority of the voters of eight cantons. The cantons have sovereign authority except in matters yielded to the federal government under the constitution, such as defense, social in-



Swiss Federal Railways

*Above Typical of the charm of towns and villages in the canton of Grisons Switzerland is Tiefencastel, which is situated on the bank of the turbulent Albula River. Picturesque villages like this have attracted the tourist to Switzerland for many years. Right The population of Grisons is typified by this elderly mountain peasant, shown smoking his pipe.*

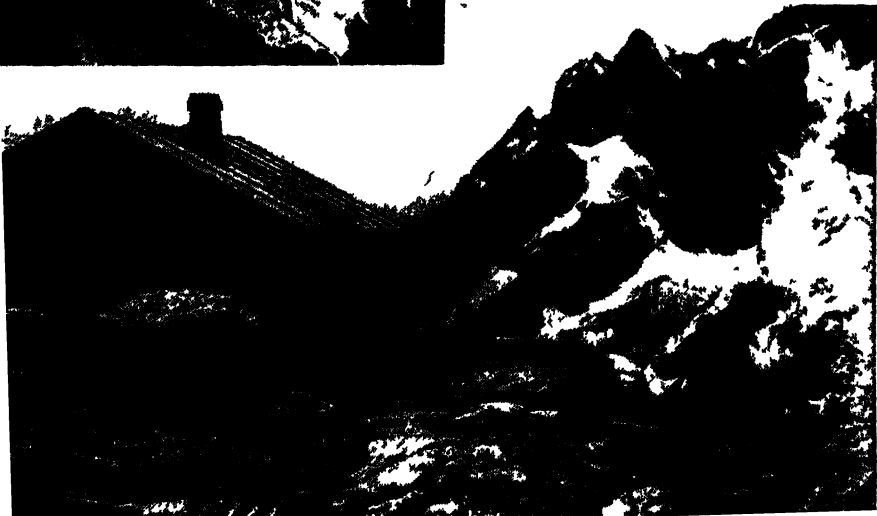




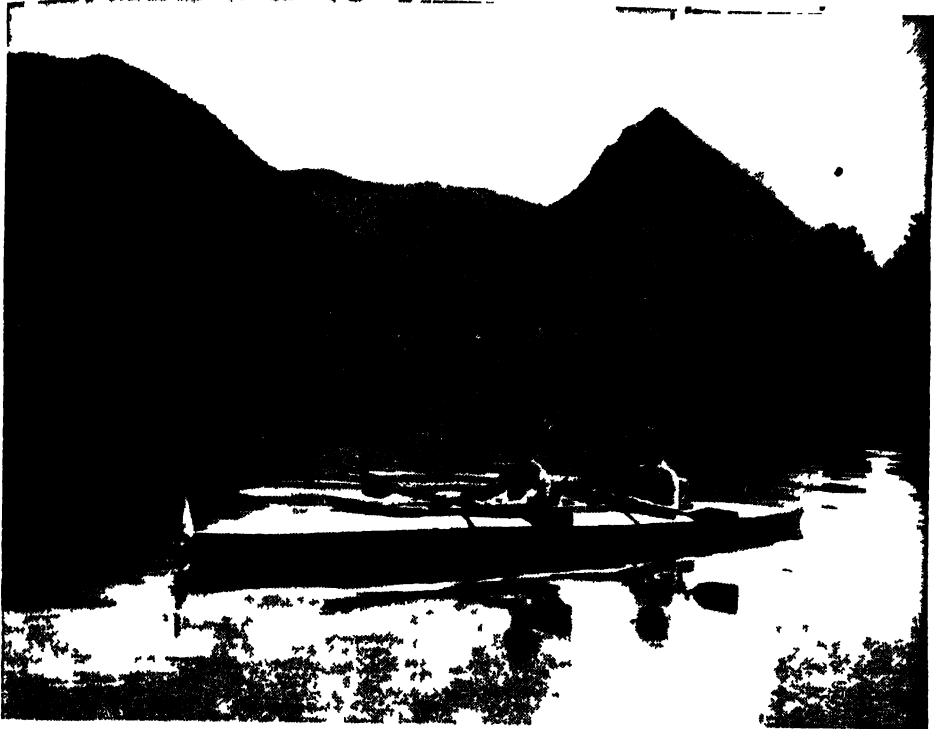
Swiss Federal Railways



*Above Riding a lift to a mountain top in the Bernese Oberland  
 Left A mountain climber in the same area Below Climbers' station in the Valais, Switzerland*







Swiss Federal Railways

*Paddle boating on the Lake of Thun, Switzerland*

insurance and international affairs, all power undelegated to the federal government; the cantonal governments vary, some still retain the ancient institutions of citizens' assembly or *Landsgemeinde*, while the large cantons have parliaments.

**History.** In pre-Roman times the territory now Switzerland was inhabited by the Helvetii in the west and the Rhaetians, a people of doubtful identities but thought to have been related to the Etruscans in the east. The Romans made themselves masters of the region, which became known as *Helvetia* in the 1st century B.C., and it became thoroughly Romanized. In the Germanic invasions which swept over the west Roman Empire in the 4th century A.D. the Burgundians and the Alamanni conquered *Helvetia*. The Alamanni were in turn conquered by the Franks about the close of the 5th century A.D., and the Burgundians came under Frankish domination in the early 6th century. Under the Franks a new civilization was introduced, based largely on a foundation of Christianity. Upon the dissolution of the Frankish Carolingian Empire

(about 814-87) most of Switzerland became part of the duchy of Alamannia, or Swabia, one of the great feudal states of the German Empire. The SW part was incorporated into the kingdom of Burgundy. In 1033 the Burgundian portion was acquired by the German emperor Conrad II, and Switzerland became a part of the Holy Roman Empire. It consisted of a collection of petty states ruled by dukes, counts, bishops, and abbots, and of a number of small city states independent by imperial charter which later became cantonal commonwealths.

In 1276 Rudolf of Hapsburg, who had been elected Holy Roman emperor three years before, attempted to assert the feudal rights of the Hapsburgs in Switzerland, making the Hapsburg power a threat to the traditional liberties of the Swiss. In 1291, to resist Rudolf's aggression, the three so-called Forest Cantons, Uri, Schwyz, and Unterwalden around Lake Lucerne, entered into a league for mutual defense. During the 14th century Zurich, Glarus, Bern, Lucerne, and Zug joined the league, and in the 15th cen-



Swiss Federal Railroads

*Boys of the Gruyère country in Switzerland singing at a festival*

tury Fribourg and Solothurn joined. (The year of entrance into the Swiss league or confederation of the remaining cantons is given in the separate articles on the cantons. In 1474 the Hapsburgs, unable to cope with the militant Swiss mountaineers, abandoned their attempts to acquire the region as a family appanage, and the Swiss confederation became directly dependent on the Empire. In 1499 Emperor Maximilian I attempted to abrogate various Swiss governmental rights; in the ensuing war he was defeated and by the Treaty of Basel (Sept. 22, 1499) he was compelled to recognize the virtual independence of the Swiss. By 1513 Appenzell, Schaffhausen, and Basel had entered the confederation, each independent as cantons and sending two delegates to a federal assembly. Because of their skill and bravery in war, Swiss mercenaries became famous throughout Europe. In the course of the Italian wars of France (see *FRANCE: History*) in the early 16th century, Swiss troops, fighting with the French as mercenaries, were able to annex the Italian

districts and towns which later formed the canton of Ticino. In 1536 the Bernese Swiss took Lausanne and various territories from the duchy of Savoy, including Vaud.

The Protestant Reformation began in 1519 in Switzerland (see *REFORMATION*, *THUR*; *ZWINGLI*; *HULDRIKH*). In 1536 Geneva revolted against the authority of the duchy of Savoy and refused to acknowledge the authority of its Catholic bishop. From 1541 to 1564 Geneva became the stronghold of Calvinism (qv). Although the cantons preserved their neutrality in the Thirty Years' War (1618-48), Swiss diplomacy was able to maneuver formal recognition of Switzerland as a completely independent state by the Peace of Westphalia (1648).

The principles of the 1789 revolution in France (see *FRENCH REVOLUTION*) spread to Switzerland. During the 1790's the French continually intervened in support of Swiss revolutionaries, a group which sought to promote political reforms and the establishment of a strong national government, and in 1798 occupied all Swiss territory. The

Swiss Confederation had until that time been a loose defensive alliance, but Napoleon Bonaparte unified the country under the name Helvetic Republic and imposed a written constitution which, like the French military occupation, was bitterly resented by most of the Swiss. In 1803, when it was to his interest to have Switzerland friendly, Napoleon withdrew the occupation troops and by the Act of Mediation granted a new constitution with Swiss approval. The Congress of Vienna, in 1815, recognized the perpetual neutrality of Switzerland, and Swiss territory was expanded to include twenty-two cantons; since that time the Swiss boundaries have remained virtually unchanged.

The period following the integration of Switzerland was one of attempted adjustment to the newly won unity. Conflict existed between autocratic and democratic elements and between Catholic and Protestant areas. In 1847 the Catholic cantons formed a league, the *Sonderbund*. The federal government declared the formation of such a league a violation of the constitution. Civil war resulted when the league refused to disband. The *Sonderbund* was defeated by the federal government, and the ensuing constitution of 1848 greatly increased the federal power. It was followed by the constitution in 1874 which, with modifications, is still in force; the 1874 constitution completed the development of Switzerland from a group of cantons linked by interests of mutual defense to a unified federal state.

Its traditional neutrality in the wars of other European nations gave Switzerland paramountcy as the site of international conferences and organizations. The headquarters of the International Red Cross was established there, as was the League of Nations following World War I. Switzerland became a member of the League of Nations, despite its international neutrality. Following World War II, however, Switzerland refused to join the United Nations, stating that the obligations of membership were incompatible with its neutrality. However, the country became a member of the Economic, Social and Cultural Organization, the Food and Agricultural Organization, the International Court of Justice, and various other agencies of the United Nations. In 1948 Switzerland joined the Organization for European Economic Cooperation (see EUROPEAN RECOVERY PROGRAM).

As a consequence of the international ten-

sions arising from the so-called cold war between the Western democracies and the Soviet bloc of states, in 1950 Switzerland launched a five-year program for the expansion and modernization of its military establishment. Proposals for financing the program subsequently encountered widespread opposition; during 1952 the Swiss electorate rejected two government-sponsored revenue-raising plans. Following the signing (July, 1953) of the armistice in Korea, Switzerland served on the Neutral Nations Repatriation Commission and the Neutral Nations Supervisory Commission.

**SWOPE**, HERBERT BAYARD (1882- ), American journalist, author, and public official, born in St. Louis, Mo. In 1914 he became a war correspondent for the St. Louis *Post Dispatch* and the New York *World*, reporting on the activities of the German armed forces. He was awarded the Pulitzer Prize for reporting in 1917. As chief correspondent for the *World* at the Paris Peace Conference of 1919, he was the first to report the text of the League of Nations covenant. From 1920 to 1929 he was executive editor of the *World*; under his direction the newspaper became famous for its crusading zeal in liberal causes, and was awarded two Pulitzer Prizes for public service. Swope helped found the American Society of Newspaper Editors in 1922, and for a time was governor of that organization. He retired from the editorship of the *World* in 1929, and subsequently held a variety of positions in public and private agencies. After the involvement of the United States in World War II he became a consultant to the secretary of war, and following the conclusion of hostilities was a member of the U.S. delegation to the United Nations Atomic Energy Commission. His best-known writings include *Inside the German Empire*, *Journalism—An Instrument of Civilization*, and *War Censorship*.

**SWORD**, weapon consisting of a long blade fixed in a hilt; when not in action it is worn in a scabbard belted to or hung at the side. In a general sense, the term connotes any side arm for cutting or thrusting, such as a rapier, saber, simitar, cutlas, or claymore. The sword always has been a personal weapon, so much so that in prose and poetry it is often endowed with superhuman qualities. To surrender the sword has always been a token of submission, and the breaking of it an impressive ceremony of degradation. In the United States Army the sword proper

has been abolished, and a single form of sabre, issued in lengths of 30, 32, and 34 inches, is worn by officers on dress parade.

**SWORD DANCE**, a dance in which the use of a sword plays the characteristic part. Such dances, held in military attire and serving as exercises of youth, were probably a feature in the life of all ancient peoples. In Greece a dance of this character was known under the name of Pyrrhic, and in Athens such a performance was said to have been instituted by the goddess Athena. The ancient Roman historian Cornelius Tacitus, in the 1st century A.D., described the youths of Germany as dancing naked over a bare blade, and fifteen centuries later a particular form of the sword dance was described by the Swedish historian Olaus Magnus as belonging to Denmark. This special dance was widely diffused and has survived in Germany, England, and Scotland. In it the number of performers was commonly six, with a leader; the movements were various, consisting of a march with weapons erect, directing them toward the center of the ring grasping the neighbor's blade by the hilt and point, forming the swords into a shield or rose and dancing with them in that form, leaping over and under the brands, and the like.

**SWORDFISH, BROADBILL, or FORKTAIL**, common name applied to a large, marine, acanthopterygian fish, *Xiphias gladius*, which constitutes the family Xiphiidae, and which is found in most seas. The swordfish, which attains a length of about 16 feet and a maximum weight of 600 pounds, has a large dorsal fin, lacks ventral fins, and is characterized by the fusion and prolongation of the bones of the upper jaw to form a stiff, rigid, swordlike beak which often constitutes one third of the total body length. This beak is used in spearing the fish and large mollusks on which the swordfish feeds; the adult swordfish has no teeth. Swordfish meat is edible and nutritious, and swordfish hunting is a profitable sport; swordfish are hunted with harpoons. The fish, when wounded, jump out of water and thrash about, thrusting their beaks at whatever is in their path. The rope tied to the harpoon is attached on its free end to a floating keg which is cast into the water with an anchor when the swordfish is speared; after the swordfish becomes exhausted in attacking the keg, the swordfish anglers approach and kill the fish with clubs. Sometimes swordfish sham exhaustion; the fish have been known to drive

their beaks into two inches of solid-wood planking in a rowboat when approached. The name "swordfish" is sometimes applied to the gar pike, the cutlass fish, and the killer whale (qq.v.). Compare SAILFISH, MARLIN; SPEARFISH.

**SWOYERSVILLE**, borough of Luzerne Co., Pa., 4 miles N. of Wilkes-Barre. Pop. (1950) 7795.

**SYBARIS**, ancient Greek city of southern Italy, situated between the rivers Sybaris (Cosile) and Crathis (Crate) about three miles from the gulf of Tarentum. It was founded about 720 B.C. by colonists from Achaia and Træzen. The city flourished and became extremely prosperous in the 6th century B.C., and its citizens led lives of such luxury and self-indulgence that their names became a byword among the peoples of antiquity; hence the modern adjective "sybaritic". In a war with the neighboring colony of Croton in 510 B.C., the city was captured and razed, and the waters of the Crathis were made to flow over the site. Descendants of the exiled Sybarites joined in the founding of Thurii (q.v.), and later established a new Sybaris on the river Treis.

**SYCAMORE**. See FIG; PLANE.

**SYCAMORE**, county seat of De Kalb Co., Ill., situated about 55 miles W. of Chicago. It is served by two railroads, and is the center and shipping point of a productive agricultural area. The principal industries in the city are the manufacture of flour, feed, canned goods, brass products, wire, cable, commutators, clothing, and waxed threads. Sycamore was founded in 1836 and named for the numerous sycamore trees in the vicinity. Pop. (1950) 5912.

**SYCOSIS**, a pustular eruption on the scalp or bearded part of the face, due to ringworm, acne, or impetigo.

**SYDENHAM**, residential section and parliamentary subdistrict of Lewisham Borough, metropolitan London, 8 miles S.E. of St. Paul's Cathedral. The Crystal Palace, erected originally in Hyde Park, London, where it housed the International Exposition of 1851, was re-erected here in 1854, and is an attractive pleasure resort. Pop., about 32,000.

**SYDENHAM**, CHARLES EDWARD POULETT THOMPSON, 1st BARON (1799-1841), British statesman, born in Wimbledon. He became governor-general of Canada in 1839 and assisted materially in bringing about the union of Upper and Lower Canada. He was created Baron Sydenham of Kent and Toronto in 1840.

**SYDENHAM, Thomas** (1624-89), English physician, often called the English Hippocrates, was born in Wingford, Eng. He established himself in practice in London about 1650 and soon became the foremost physician of his time. He is especially noted for having introduced cinchona in the treatment of malaria, differentiated between scurvy and measles, classified cholera, and expounded on the use of tincture of opium. (Sydenham's Laudanum) was introduced by him. His *Præcepta Medica* (1676) was long the standard book for English practitioners.

**SYDNEY**, the capital of New South Wales, Australia, and the principal port of that continent, situated on the southern shore of Port Jackson, about 8 miles W. of the Pacific Ocean. The inlet of Port Jackson is one of the finest harbors in the world, and the largest vessel can anchor in it. The port facilities of Sydney consist of the Sydney Harbour Trust, amount to about 6,000 ft. of wharves. In the inlet are situated nine islands, one of which (Cockatoo Island) is a Government dry-docks. The city is defended by modern forts and batteries, and is the chief Australian naval station. Its metropolitan area includes Sydney proper (with North Sydney) and its suburbs, forty-eight municipalities. It is a handsome modern metropolis, with numerous parks and about 650 acres of public parks. Three suburban colleges are included in the University of Sydney (founded 1850): St. Paul's (Anglican), St. John's (Roman Catholic), and St. Andrew's (Presbyterian). The most important manufactures are metal, machinery, clothing, food products, and beverages. Sydney is the leading commercial, financial, storage, and shipping center of New South Wales. It is the outlet for a vast interior mining and pastoral region, and its exports of gold, leather, and wool are of great importance in the Australian economy.

Sydney is the oldest city in Australia, its site having been selected in 1788 a few days after the first party of British colonists landed. The growth of the city was rapid in the latter part of the 19th century. The first governor-general of the Australian commonwealth, John Adrian Louis Hope, Earl of Hopetoun, was installed in Sydney on Jan. 1, 1901. Pop. (1954 est.) 1,861,685.

**SYDNEY**, city, seaport, and county seat of Cape Breton Co., Nova Scotia Province, Canada, situated on the harbor of the same name on the N.E. coast of Cape Breton I., about 700 miles N.E. of Halifax. It lies in a rich coal-pro-



View of New Information Bureau  
Central district of Sydney, Australia

ducing region, has excellent harbor and rail facilities, and is a leading industrial and shipping center, with shipyards and some of the largest iron and steel works in Canada. Other industrial establishments include factories engaged in the manufacture of chemicals, wood products, metal goods, and processed food. North Sydney and Sydney Mines, important coal and steel centers, are situated on Sydney Harbour, opposite the city. Among noteworthy points of interest are the city hall, the mining and engineering school, and St. George's Church (founded 1786), one of the first Anglican churches established in Canada. The Fortress of Louisbourg, a Canadian national historic park, is about 15 miles S.W. of the city.

Sydney was founded in 1784 as the capital of Cape Breton Island, which had been separated from Nova Scotia that year and established as a separate colony. It ceased to be the

colonial capital in 1820, when Cape Breton I. Colony was reunited with Nova Scotia. Pop. (1951) 31,317.

**SYENITE**, an igneous, coarse-grained, light-colored rock, composed essentially of alkali feldspar (q.v.) and oligoclase, and usually containing lesser amounts of magnetite, apatite, zircon, biotite, hornblende, and pyroxene. In nephelite syenites, the mineral nephelite is associated with the feldspar in amounts greater than five percent; some nephelite syenites may contain small amounts of sodalite or corundum (qq.v.); see **NELPHETINE**. Other syenites, containing appreciable amounts of biotite, are often classified as mica syenites. Leucite syenites contain leucite (q.v.) in amounts greater than five percent. Syenite is named after the area of Syene on the Nile in Upper Egypt, where in ancient times the Egyptians used a syenite-like granite as a building stone. Large European deposits of syenite are located in Switzerland, Germany, and Norway. In the United States it occurs as syenite gneiss, which is mined chiefly in New England and the States of New York, Arkansas, and Montana.

**SYKES, GEORGE** (1822-80), American soldier, born in Dover, Del. He was commissioned a brigadier general of volunteers on the outbreak of the Civil War, and fought in the peninsula campaign and with the army of the Potomac at Chancellorsville and Gettysburg. At the close of the war he was brevetted brigadier general of the United States Army, and commanded several frontier posts, being in command of Fort Brown, Tex., at his death. A monument to the memory of George Sykes was erected in West Point Cemetery.

**SYLACAUGA**, a city of Talladega Co., Ala., situated about 45 miles s.e. of Birmingham. Transportation facilities include a railroad. Sylacauga is surrounded by a cotton-growing area, and in the city and vicinity are extensive marble quarries. The entire city is underlaid with veins of marble, and Sylacauga marble has been used in the construction of many famous buildings, including the Lincoln Memorial and the U.S. Supreme Court Building in Washington, D.C., and the General Motors Building in Detroit, Mich. A notable annual event in Sylacauga is the Cotton States Tennis Tournament. Pop. (1950) 9606.

**SYLHET**, formerly the name of a district and of its administrative center, in Assam,

British India; after the partition (1947) of India, the name of a region and city of East Bengal, Pakistan. The region of Sylhet, which occupies part of the valley of the Surma R. in N.E. India, is intensively cultivated and well irrigated. Tea is the principal crop. Valuable deposits of lime are situated in the region. Manufactures include shell buttons, perfume, boats, and reed mats. The city of Sylhet lies on the Surma R., about 125 miles N.E. of Dacca. It is a trading center and is served by a railway. Several educational institutions, notably Muralichand College, are situated there. Area of former district, 5478 sq.m.; pop. (1941) 3,116,602. Pop. of city, about 28,000.

**SYLLABUS**, term from the Greek usually applied to a compendium or abstract of a lecture or series of lectures. The term is applied particularly to the papal syllabus that accompanied the encyclical *Quanta Cura* (1864), addressed by Pope Pius IX to all Roman Catholic bishops.

**SYLLABUS ERRORUM** (Lat., "catalogue of errors"), a document published by Pius IX in 1864, condemning eighty doctrines which it calls "the principal errors of our times." The *Syllabus* gave rise in England to a famous controversy between the statesman William Ewart Gladstone and the theologian John Henry Newman. The name "syllabus" is also used for the decree of Pius X, 1907, condemning modernism in sixty-five propositions. See **MODERNISM**.

**SYLLOGISM**, a logical formula, or analysis of a formal argument, consisting of three propositions, the first two of which are called the *premises*, and the third the *conclusion*. Fully expressed, a syllogism consists of (1) a major premise or rule; (2) a minor premise or case, and (3) a conclusion or application. See **LOGIC**.

**SYLPHS**, in the fantastic system of the Paracelsists, the elemental spirits of the air, just as the salamanders are of fire and the gnomes of earth. In common usage the term "sylph" is applied to a graceful maiden—a change of meaning probably owing to the popularity of Pope's *Rape of the Lock*, which introduced the term into the world of fashion and literature.

**SYLVANIA**, county seat of Screven Co., Ga., situated near the Savannah R., about 60 miles N.W. of the city of Savannah. It is served by two railroads. The city is the center of a cotton-growing and lumbering area. Pop. (1950) 2939.

**SYLVANITE**, or GRAPHIC TELLURIUM, an opaque, silver-white, gray-streaked mineral occurring as a telluride of gold or silver, (Au,Ag)Te<sub>2</sub>, and crystallizing in the monoclinic system. It was named after the Romanian province of Transylvania, where it was first discovered; see CALICRITITE.

**SYLVESTER**, the name of two popes. **1.** SYLVESTER I (314-35) is claimed to have baptized Constantine the Great, and to have received from him the famous Donation. He was canonized, his feast day falling on December 31. His reign was the first in the new period of church freedom under Constantine. **2.** SYLVESTER II (about 940-1003), whose name was Gerbert, was born in Aurillac in Auvergne. Made abbot of Bobbio by Otto II, he became archbishop of Ravenna (998), from which he proceeded to the papal chair in 999.

The name was also borne by two anti-popes, SYLVESTER III, who contested the papal throne with Benedict IX in 1044, and SYLVESTER IV, who was put up by the Imperial Party to oppose Nicholas II in 1057.

**SYLVESTER**, JAMES JOSEPH (1814-97), English mathematician, born in London, of Jewish parents. In 1877 he became the first professor of mathematics at Johns Hopkins University, which position he held for seven years, returning to England to accept the Savilian professorship of geometry at Oxford. He founded the *American Journal of Mathematics* and was for some years its editor. Sylvester's contributions are devoted chiefly to the theories of algebraic forms, in which he was the recognized leader of the mathematical world.

**SYLVESTER**, JOSHUA (1563-1618), English poet, born in the north of Kent. His life was divided between poetry and trade. He is mainly known for a translation, or rather paraphrase in translation (1592), of the *Semaines*, a sacred epic by the French poet Guillaume du Bartas (q.v.). The translation had considerable influence upon the work of the English poet John Milton. Of Sylvester's original verse, all is forgotten except the well-known sonnet beginning "Were I as base as is the lowly plaine".

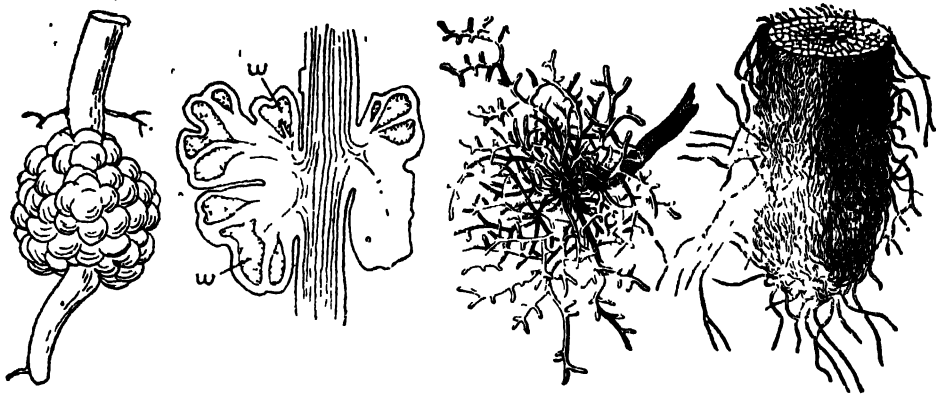
**SYLVIADAE**. See WARBLER.

**SYLVITE**, a compact, granular, transparent mineral consisting of potassium chloride, KCl, and crystallizing in the hexoctahedral system. It exhibits perfect cubic cleavage, has a hardness of 2, a specific gravity of 1.99, and is readily soluble in water. The color ranges from colorless or white in the

pure state to blue, yellow, or red when impurities are present. Sylvite was originally known to chemists as *sal digestivus Sylvii*, and was observed in 1823 as an incrustation on the lava deposits of Mt. Vesuvius. It occurs usually in salt deposits together with halite (q.v.), and is extracted as a precipitate of the salt solution. The principal sources of sylvite are the salt deposits at Stassfurt, West Germany, and Kalusz, Poland; in the U.S. sylvite deposits occur in New Mexico, and w. Texas. Sylvite is used as a source of potassium and of potassium compounds, important in the manufacture of fertilizers.

**SYLVIVUS**, the Latinized name of JACQUES DUBOIS (1478-1555), French anatomist, born in Amiens, as well as that of FRANZ DE LA BOE (1614-72), German physician and anatomist born in Prussia. Their anatomical discoveries and medical inventions cause them to be remembered. The Sylvian fissure, the Sylvian aqueduct, and the Sylvian artery were named in their honor.

**SYMBIOSIS** (Gr. *symbiōn*, "to live together"), in biology, the intimate association of two organisms of different species. The type of symbiosis resulting in mutual benefit to the symbionts is commonly known as *mutualism*. An example of mutualism is the relationship of various green algae of the genus *Zoochlorella* with the fresh water ciliate jellyfish, *Hydra viridis*. The algae, which are found in the endoderm cells of the jellyfish, supply part of the animal's food requirements, and in return are sheltered by the body of the animal. Another type of symbiont, commonly called *mycorrhiza*, involves fungi of the class *scleromycetes* and seed plants such as heathers, orchids, and beeches. The fungi penetrate the roots of the plants, and make available to the plant soil nutrients such as nitrogen, receiving carbohydrates in return. Some organisms exhibit relationships in which one symbiont grows almost entirely at the expense of the other. This type of symbiosis, commonly known as *helotism*, or *contingent symbiosis*, is exhibited by lichens (q.v.), in which a fungus exists entirely at the expense of an alga and provides only the alga's water supply. In *antagonistic*, or *antiparasitic*, symbiosis, one organism is often killed or seriously injured in satisfying the needs of the other. This type of association is more commonly known as parasitism; see PARASITE. Among social insects such as ants, bees, and wasps (q.v.), there often exists a relationship known as *social symbiosis*, in which members



**SYMBIOSIS.** *Left: Bacterial nodule on root of a lupine. Bacteria derive nutrients from root while providing nitrogen for it. Middle, left: Cross section of same showing tissue infected with bacteria (w). Middle, right: White poplar roots with fungus covering, another example of mutualism. Right: Beech root with a fungus, a similar case.*

of different families live in the same nest, share the same food, and care for each other's young. Some organisms exist together for the purpose of sharing food and disguising each other from their natural predators; see **COMMENSALISM**.

**SYMBOLISM** (Gr. *symbolon*, "a mark or token whereby a thing is known or intimated"), the representation of a thing (generally an idea, emotion, quality, or value) by means of a sign or emblem which stands for or suggests the thing. The basis of symbolism is an actual relationship, an association, or a fortuitous resemblance between the symbol and the thing symbolized. Symbolism is employed most notably in language, literature, art, religion, logic, and the study of psychology. The use of words to denote ideas and the use of visible signs to represent spoken sounds are instances of symbolism in language; more complex linguistic symbolism is illustrated in such figures of speech (see **SPEECH, FIGURES OF**) as metaphor, metonymy, personification, simile, and synecdoche. The chief forms of literary symbolism are the allegory and the fable (qq.v.), the myth (see **MYTHOLOGY**), and the parable (q.v.). More specifically, the term "symbolism" is employed to designate a literary and esthetic movement which took place in France from about 1880 to the turn of the century (see **SYMBOLISTS, THE**).

Symbolism figures prominently in the art (particularly the religious art) of all nations. In European art, for example, from ancient times to the present, the olive branch has

denoted peace, the palm, triumph, and the anchor, faith or hope. In early Christian art, Jesus Christ was depicted in terms of a variety of symbols, notably the lamb, because the lamb was in ancient times a well-known sacrificial animal, and Jesus, called the Lamb of God, offered himself as a sacrifice to redeem mankind; the fish, because the five letters constituting the Greek word for "fish" are identical with the initial letters of the five Greek words meaning "Jesus Christ, Son of God, Savior"; and the Greek letters Alpha and Omega, denoting respectively the beginning and the end. Other symbols of Christian art include the peacock (an emblem of immortality); the phoenix (a figurative representation of the Resurrection), the ship (signifying the Church, in which the devout are transported safely over the sea of life); the serpent or dragon (a designation of Satan); and the stag (an emblem of the soul thirsting for baptism). In Christian art of the late Middle Ages, each of the saints of the Church is designated by an appropriate symbol; thus, St. Andrew is identified by a cross in the shape of an X, and St. Dominic by a lily and a star above his forehead. In religious ritual, symbolism plays an important part in the worship of most Christian denominations, particularly in that of the Roman Catholic Church and the Orthodox Church (qq.v.); see **LITURGY; MASS**.

Symbolism occurs in logic (q.v.) in formal units of expression, such as a formal argument, proposition, or term, which stand



for phases of thought susceptible of being treated as a unit. So-called *symbolic logic* applies the principles and terminology of mathematics to logical reasoning, thereby overcoming the principal defect of conventional or Aristotelian logic, the inexactitude of its verbal terminology. The application of mathematical symbols of relationship to logical propositions removes the possibility of ambiguity and overcomes the limitations inherent in language, thus permitting the extension of the field of logic far beyond its former limits.

In modern therapeutic psychology (qv) particularly in psychoanalysis (qv) as formulated by Sigmund Freud (qv), and elaborated and modified by such of his followers as Alfred Adler, Abraham Arden Brill, Carl Gustav Jung, and Wilhelm Stekel (qv), symbolism refers to the utilization of object and acts by means of which the dynamic life of the unconscious mind in its waking and dream states finds condensed and disguised expression. The unconscious symbolism constructs in the familiar phenomenon of everyday experience a kind of "language" through which the individual represents projected and impulsive of which he is not consciously aware. One of the functions of the psychoanalyst or psychiatrist is to interpret the cryptic symbolism of his patient so that they may gain an insight into their own repressed desires and emotional conflicts and thus be able actively to attack the pathological thought in correcting unconscious conflict.

**SYMBOLISTS**, the name of a class of writers which sprang up after 1880, not only in France, but in connection with various other Symbolist groups and within the expression of individuality by the introduction of a being or an object into the poem.

If such expression is characteristic of the modern age, the Symbolists are in direct antagonism against realism. They concern themselves with general truths in contrast with actualities. Dreams, visions, and mythological tales are their proper subjects, and lyricism their favorite form of poetic expression. The influence of the Symbolists has been for the exclusive, the refined, the delicate, and the mystic beauties of the supernatural. Verlaine, Mallarmé, and Rimbaud are the most noteworthy of the French and Belgian Symbolists. Symbolism reaches also into the domain of contemporary painting.

The term *Décadent* began to be denisively

applied, in France, about 1882 to the group of young poets who later called themselves Symbolists. The *Décadents* of Paris were specifically little more than curiosities, but in their connection with symbolism they were not without effect on literature and art. Among those who have been associated in France, in the public mind, with *Décadentisme* may be mentioned Maurice Barres, De Rognier, Gustave Kahn, the two Belgians Maeterlinck and Rodenbach, the Greek Moreas, and the Americans Valéry Griffin and Stuart Merrill. In England Aubrey Beardsley, with his fantastic pictorial art, was considered a conspicuous Decadent.

**SYMBOLS, MATHEMATICAL**, the various signs and abbreviations used to facilitate mathematical expression. They are of the following kind:

Of value

Hindu and Greek numerals (See NUMERICALS AND ALGEBRA)

Of operation

Addition  $+$

Subtraction  $-$

Multiplication  $\times$  or  $\cdot$   $a \times b$  or  $ab$

Division  $\div$  or  $/$   $a \div b$  or  $a/b$

Exponentiation  $a^b$  or  $a^b$

Logarithm  $\log$  or  $\lg$

Involution

Extraction  $\sqrt[n]{x}$

Differentiation  $d$  or  $\frac{d}{dx}$

Integration  $\int$

Binomial  $\binom{n}{r}$  or  $\frac{n!}{r!(n-r)!}$

Of function

(1)  $f(x)$  or  $F(x)$  for  $f$  or  $F$  function of  $x$

Of quantity

Positive number  $+$

Negative number  $-$

Absolute value  $|x|$

Imaginary unit  $i$  or  $\sqrt{-1}$

Decimal as in (U.S.)  $3.2$  (England),  $32$  (Continental)

Of relation

Equality  $=$

Identity  $\equiv$

Inequality as in  $a < b$  ( $a$  less than  $b$ )

$a > b$  ( $a$  greater than  $b$ ),  $a < b$  ( $a$  not less than  $b$ ),  $a \nless b$  ( $a$  not greater than  $b$ ),  $a \neq b$  ( $a$  not equal to  $b$ ).

Of continuation.

....., as in  $a, a', a'', \dots$

Of deduction.

$\therefore$  (since).

$\therefore$  (therefore).

Of aggregation.

$( )$ ,  $[ ]$ ,  $\{ \}$ ,  $—$ .

Of denominate numbers, as in \$10, 3° 4' 15" (degrees, minutes, seconds), £20 3s.

2d. (pounds, shillings, pence), cwt. (100 lbs.), and various abbreviations.

Of geometry.

$\angle$ ,  $\angle^s$  (angle, angle<sup>s</sup>).

$\perp$  (perpendicular to).

$\parallel$  (parallel to).

$\sim$  or  $=$  (congruent to).

$\simeq$  (similar to).

$\doteq$  (approaches as a limit).

$\triangle$ ,  $\triangle$  (triangle, triangles).

$\odot$ ,  $\odot$  (circle, circles).

$\square$ ,  $\square$  (square, squares).

$\square$ ,  $\square$  (rectangle, rectangles).

$\square$ ,  $\square$  (parallelogram, parallelograms).

$\frown$  (arc).

$a$  (radians).

The question of the origin and development of mathematical symbols is a large one, and science has not yet given satisfactory answers at many points. The probable origin of the remarkable digits 1 through 9 is discussed under NUMERALS. The origin of zero is unknown, there being no authentic record of its history before 400 A.D. The extension of the position system below unity is attributed to Stevin (1585), who called tenths, hundredths, thousandths, . . . *primes*, . . . *sekondes*, *terzes*, and wrote subscripts to denote the orders; thus, 4.628 was written 4(<sub>0</sub>) 6(<sub>1</sub>) 2(<sub>2</sub>) 8(<sub>3</sub>). But Pellos (1492) used a period to set off the decimal part of a number, and a bar was used for this purpose by Rudolff (1526), Cardan (1539), Cataneo (1546), and various other writers. The first man who seems to have fully comprehended the significance of this separation of the integral and decimal parts was Rudolff, in whose *Exempelbüchle* of 1530 an example in compound interest is solved, and full use is made of the decimal fraction. Kepler (1571–1630) used the comma to set off the decimal orders, and Bürgi (1552–1632) and Pitiscus (1612) in their tables used the decimal fraction in the form 0.32, 3.2, but they also used other methods of indicating decimals. Although the early Egyptians had symbols for addition

and equality, and the Greeks, Hindus, and Arabs symbols for equality and for the unknown quantity, from earliest times mathematical processes were cumbersome for lack of proper symbols of operation. The expressions for such processes were either written out in full or denoted by word abbreviations. The later Greeks, the Hindus, and Jordanus indicated addition by juxtaposition; the Italians usually denoted it by the letter  $P$  or  $p$  with a line drawn through it to distinguish it as an operation, but their symbols were not uniform. Pacioli, for example, sometimes used  $p$  and sometimes  $e$ , and Tartaglia commonly expressed the operation by  $\phi$ . The German and English algebraists introduced the sign  $+$ , but spoke of it as *signum additorum* and first employed it only to indicate excess. Subtraction was indicated by Diophantus by the symbol  $\nearrow$ . The Hindus used a dot, while the Italian algebraists denoted it by  $M$  or  $m$  with a line drawn through the letter. The symbols  $m$  and  $de$  were, however, used by Pacioli. The German and English algebraists were the first to use the present symbol and described it as *signum subtractorum*. The symbols  $+$  and  $-$  appeared first in print in an arithmetic of Widman (1489). The symbol  $\times$  for "times" is due to Oughtred (1631). To Rahn (1659) is due the sign  $:$  for division used in the English-speaking countries; Harriot (1631) used a period to indicate multiplication, and Descartes (1637) used juxtaposition. Leibnitz in 1688 employed the sign  $\sim$  to denote multiplication and  $\simeq$  to denote division. Division among the Arabs was designated variously by

$a - b$ ,  $a/b$ ,  $\frac{a}{b}$ , but Clairaut (1760) made

familiar the form  $a : b$ . Descartes made popular the notation  $a^n$  for involution and Wallis defined the negative exponent. The symbol of equality,  $=$ , is due to Recorde (1557), and the symbols  $>$ ,  $<$ , for greater than and less than, originated with Harriot (1631). Viète (1591) and Girard (1629) introduced various symbols of aggregation. The symbol  $\infty$  for infinity was first employed by Wallis in 1655. The symbols of differentiation  $dx$  and of integration  $\int$  as used in calculus are due to Leibnitz, as is also the symbol  $\sim$  for similarity, as used in geometry. The symbolism  $\phi$ ,  $f$ ,  $F$ , as used in theory of functions, is due to Abel.

**SYME, JAMES** (1799–1870), Scottish surgeon, born in Fife. He was clinical professor (1829–33) in Minto House Hospital, which

he founded at his own expense. In 1861 he was appointed surgeon in ordinary to the queen in Scotland. He devised resection of the joints, Syme's amputation of the foot, and, excision of the lower jaw.

**SYMINGTON, WILLIAM** (1763-1831), British inventor, born in Leadhills. In 1786 he constructed a working model of a steam-road carriage, and afterward patented a steam engine in which he obtained rotary motion by chains and ratchet wheels. In 1788 he and Patrick Miller used an engine constructed on the lines of this patent to propel a small pleasure boat on Dalswinton Loch. In 1801 he patented another engine in which a piston rod guided by rollers was connected by a rod to a crank attached to the paddle-wheel shaft. In the following year he fitted out a boat called the *Charlotte Dundas*, which proved able to tow two barges a distance of 19½ miles in 6 hours.

**SYMMACHUS, SAINT** (fl. 6th century), Pope from 498 to 514, born in Sardinia. He was chosen to fill the vacancy left by the death of Anastasius I. A minority, however, of the Byzantine faction, set up as a rival the archipresbyter Laurentius. As a result of the schism bloody encounters took place. Symmachus was established in office with the favor of the Ostrogothic king Theodoric.

**SYMMACHUS, QUINTUS AURELIUS** (345?-410? AD), Roman orator, scholar, and statesman, and a defender of paganism in both literature and private life. He was educated in Gaul and was prefect of Rome in 384 AD, being elected consul seven years later. In an age when paganism was almost extinct, Symmachus sought to regain for it a place of honor in the state. His extant writings consist of ten books of letters and the fragments of nine orations.

**SYMME, JOHN CLIVES** (1742-1814), American soldier and pioneer, born in Southold, Long Island. During the American Revolution he served as a colonel in the Continental militia of New Jersey, aided the retreat of Washington's army across the State in 1776, and fought at the Battle of Monmouth and elsewhere. From 1780 to about 1788 he was a resident of New Jersey. He was elected a member of the Continental Congress from New Jersey in 1785 and re-elected in 1786. The following year he became interested in the possibilities of colonizing the land between the Miami and the Little Miami rivers in the Northwest Territory (now in Ohio). In 1788 he received a million acres of land in that region from

Congress, and subsequently founded a number of settlements on his holdings. The principal settlement was the present-day city of Cincinnati, which under his direction became one of the principal commercial and military centers of the territory west of the thirteen original States. Symmes paid for and received title to a little over three hundred thousand acres. He was careless in drawing the terms of contracts for the sale of his land and by the time of his death had lost most of his property through lawsuits. From 1788 to his death he was a Federal judge in the Northwest Territory.

**SYMMETRY**, the general tendency in animals toward a symmetrical arrangement of parts. Thus, man is bilaterally symmetrical, the external parts or limbs being arranged in pairs on each side of his body. So with the annelid worms, the lobster, centipede, and scorpion. On the other hand, this symmetry is lacking in those internal organs which are single.

**SYMMETRY**, a term used in geometry to express a characteristic property of two congruent or quasicongruent figures which have a certain relation with respect to a point, line, or plane. Two systems of points are said to be symmetric with respect to an axis when all lines are bisected at right angles by that axis. Two figures are said to be symmetric with respect to an axis when their systems of points are symmetric with respect to that axis. A figure is said to be symmetric with respect to an axis when the axis divides it into two symmetric figures. Two figures are said to be symmetric with respect to a center when their systems of points are symmetric with respect to that center. Figures of three dimensions besides being symmetric with respect to an axis or a center may be symmetric with respect to a plane. Symmetric polyhedral angles may be considered as quasicongruent and are such as have their dihedral angles equal, and the plane angles of their faces also equal, but arranged in reverse order.

In algebra, an algebraic function is said to be symmetric with respect to certain letters when these letters can be interchanged without changing the form of the expression.

**SYMMONDS, JOHN ADDINGTON** (1840-93), English critic and literary historian, born in Bristol. His first book, *Introduction to the Study of Dante* (1872), was a commentary on the great Italian's poem; it was followed by *Studies of the Greek Poets* (1873-76). But his most notable achievement is *The*

*History of the Italian Renaissance* (7 vols., 1875-86). *Shakespeare's Predecessors*, published in 1884, contains the results of thoughtful study in English literature. Symonds made an interesting collection of students' Latin songs of the 12th century under the title of *Wine, Women, and Song*.

**SYMONS, ARTHUR** (1865-1945), English critic and poet, born in Wales. Among his earlier works are *An Introduction to the Study of Browning* (1886), *Studies in Two Literatures* (1897), *The Symbolist Movement in Literature* (1899), and *Collected Poems* (1901). His later works include *Figures of Several Centuries* (1915), *Studies in Elizabethan Drama* (1920) *Charles Baudelaire* (1921), *Translations from Baudelaire* (1925), *Eleanora Duse* (1926), *A Study of Thomas Hardy* (1927), and *Confessions* (1930).

**SYMONS, GEORGE GARDNER** (1861-1930), American landscape painter, born in Chicago. His paintings are to be found in most public museums; they include "Winter Sun" and the "Top of the Hill and Beyond" in the Chicago Art Institute; "Opalescent River" in the Metropolitan Museum of Art, New York City; "Snow Clouds", Corcoran Art Gallery, Washington; "Snowclad Fields in Morning Light", Toledo Museum; and "Sorrow", Cincinnati Museum. Later works are "Winter Evening" and "Melting Snow". In 1909 he was awarded the Carnegie prize of the National Academy of Design, of which he was elected a member in 1911. He received the prize and gold medal awarded by the National Arts Club in 1912, and in 1914 was elected to the National Institute of Arts and Letters.

**SYMONS, GEORGE JAMES** (1838-1900), English meteorologist, born in London. From 1857 until his death he was meteorological reporter to the registrar general, and after 1860 issued 39 annual volumes of statistics (British Rainfall) on observations, at first from 168 stations in England and Wales, but finally from 3528 stations in Great Britain and Ireland. In 1863 he started the issue of a monthly rain circular, which in 1866 developed into the *Monthly Meteorological Magazine*. Symons was president of the Meteorological Society in 1880 and in 1900.

**SYMPATHETIC SYSTEM.** See **NERVOUS SYSTEM**.

**SYMPHONIC POEM**, in music, a composition for symphony orchestra, differing from the symphony (q.v.) in that it has no prescribed form, consists generally of but one

movement of indeterminate length, and is based upon a specific program (see **PROGRAM MUSIC**). The symphonic poem developed from the so-called "program symphony", a form devised by the 19th-century German violinist and composer Louis Spohr. The descriptive title "symphonic poem" was first employed by the German Romantic composer Franz Liszt, and applied to thirteen of his programmatic works. Liszt's musical device of the "transformation of themes", analogous to the varied theme called an *idée fixe* (Fr., "fixed idea") by the French composer Louis Hector Berlioz and a *leitmotiv* (Ger., "leading motive") by the German composer Richard Wagner, furnishes a unifying element in his symphonic poems.

During the second half of the 19th century the form was adopted and developed by such composers as Bedřich Smetana in a cycle of six symphonic poems bearing the generic title *My Country* (1861), of which the most familiar section is *The Moldau*; Aleksandr Porfirevich Borodin in *On the Steppes of Central Asia* (1880); Mili Alekseevich Balakirev in *Tamara* (1882); Anatole Liadov in *Kikimora* and *The Enchanted Lake*; and Modest Petrovich Moussorgsky in *Night on Bare Mountain* (1867). The Russian composer Petr Ilich Tchaikovsky called his compositions *Francesca da Rimini* (1876), *Hamlet* (1885), and *Romeo and Juliet* (1870) "fantasy overtures", but these works are generally considered symphonic poems. Symphonic poems were also composed by the French composers Camille Saint-Saëns and César Auguste Franck, the former in his *Phaëton* (1873), *Le Rouet d'Omphale* ("The Spinning Wheel of Omphale", 1871), *Danse Macabre* (1874), and *The Youth of Hercules* (1877), and the latter in his *Eros and Psyche* (1887-88), *Le Chasseur Maudit* ("The Accursed Hunter", 1882), *Les Éloïdes* ("The Daughters of Eolus", 1876), and *Les Djinns* ("The Jinns", 1884). The French Impressionist (see **IMPRESSIONISM**, in music) composer Achille Claude Debussy wrote notable symphonic poems in his *Afternoon of a Faun* (1892-94), *The Sea* (1903-05), and *Nocturnes* (1893-99). Other composers who utilized the form were Paul Abraham Dukas, in *The Sorcerer's Apprentice* (1897); Maurice Joseph Ravel, in *La Valse* (1920); Sir Edward Elgar, in *Falstaff* (1913); and Sir Granville Bantock, in *The Witch of Atlas* (1902) and *Fifine at the Fair* (1902).

The most distinguished exponent of the symphonic poem after the time of Liszt was

the German composer Richard Strauss. Strauss, who called his works in this genre *Tondichtungen* ("tone poems"), considerably expanded the expressive possibilities of the form. His tone poems include *Don Juan* (1889), *Death and Transfiguration* (1890), *Macbeth* (1890), *Till Eulenspiegel's Merry Pranks* (1895), *Thus Spake Zarathustra* (1896), *Don Quixote* (1898), and *A Hero's Life* (1899). Since the turn of the 20th century, a considerable number of symphonic poems have been composed, among them *The Death of Tintagiles* (1905) and *A Pagan Poem* (1905-06), by Charles Martin Tournay; *Pacific 231* (1923) and *Rugby* (1928), by Arthur Honegger; *A Victory Ball* (1923), by Ernest Henry Schelling; *The Fountains of Rome* (1917), *The Dance of the Gnomes* (1920), *The Pius of Rome* (1924), and *Roman Festivals* (1929), by Ottorino Respighi; and *Pohjola's Daughter* (1906), *Nightride and Sunrise* (1909), *En Saga* (1892), *The Swan of Tuonela* (1893), *The Oceanides* (1914), and *Tapiola* (1925), by Jean Sibelius.

For further information, see articles on all composers mentioned in this article.

**SYMPHONY** (Gr. syn. "with"; *phōnē*, "sound"), in music, the most elaborate form of purely orchestral composition. The term was first used in the 17th century as a designation for the instrumental portions of primarily vocal works, and included, the overture, the *ritornello* (qq.v.), and dances and interludes from such types of composition as the cantata, mass, opera, and oratorio (qq.v.). Symphonies, in this early meaning of the term, were composed by the Italian composers Jacopo Peri and Claudio Monteverdi. The modern symphony is an outgrowth of the Italian operatic overture, a three-movement work which came into prominence in the latter part of the 17th century and began to take on the characteristics of the sonata (q.v.) early in the 18th century. The development of the symphony as an abstract and separate musical form began about the middle of the 18th century. The three parts of the old Italian overture were freed from their conventional sequence of *Allegro-grave-presto* and became entirely separate movements, which could be performed in any order. At the same time the resources of the orchestra were considerably augmented by the addition of such instruments as bassoons, flutes, horns, oboes, and trumpets; see ORCHESTRATION. A fourth movement, the minuet (q.v.), was introduced

by the 18th-century composer Johann Stamitz, who also employed the sonata form in the first movement of his symphonies. Other notable symphonic composers of the 18th century were Karl Friedrich Abel, Johann Christian Bach, Karl Philipp Emanuel Bach, Karl Ditters von Dittersdorf, François Joseph Gossec, Franz Joseph Haydn, Wolfgang Amadeus Mozart, and Franz Xaver Richter.

The great 19th-century German composer Ludwig van Beethoven made important innovations in both the structure and instrumentation of the symphony. He expanded the development section of the first movement, and replaced the minuet by the more elaborate scherzo (q.v.). In the fourth movement of his monumental *Ninth Symphony*, Beethoven introduced a choral arrangement of the *Ode to Joy* by the German poet Johann Christoph Friedrich von Schiller, thereby establishing a precedent in symphonic writing subsequently followed by a number of composers of the 19th and 20th centuries. Choral symphonies were written by Franz Liszt (*Dante Symphony*, 1855; *Faust Symphony*, 1861), Gustav Mahler (2nd Symphony, 1894; 4th Symphony, 1900; and 8th Symphony, 1907), Ralph Vaughan Williams (*A Sea Symphony*, 1910), Igor Fedorovich Stravinsky (*Symphony of Psalms*, 1930), and Sergei Wassilievitch Rachmaninoff (*The Bells*, 1913). Although many composers after Beethoven greatly enriched the symphonic repertoire, they made no significant modification in the fundamental character of the genre. Outstanding among these composers were Franz Peter Schubert, Felix Mendelssohn, Robert Schumann, Johannes Brahms, Anton Bruckner, César Auguste Franck, Camille Saint-Saëns, Aleksandr Porfirievich Borodin, Nikolai Rimski-Korsakov, Piotr Ilich Tchaikovsky, Anton Rubinstein, Reinhold Glière, Aleksandr Konstantinovich Glazunov, Sergei Prokofiev, Dimitri Shostakovich, Anton Dvořák, Jean Sibelius, Ralph Vaughan Williams, Arnold Bax, Roger Sessions, Aaron Copland, Howard Hanson, Roy Harris, and Samuel Barber.

For further information, see articles on all composers mentioned.

**SYMPHORICARPOS**, a genus of shrubs of the Hoi-suckle family, Caprifoliaceae, having oval, short-petioled, downy leaves, and short clusters of white or rose-colored flowers followed by fleshy white or red berries. The best known are the coralberry, *Symphoricarpos vulgaris*, the wolfberry, *S. occidentalis*, and the snowberry, *S. racemosus*.

**SYMPLEGADES** (Gr., "clashing rocks"), in Greek mythology, two huge rocks which dashed against each other, crushing ships between them. They were said to have become stationary after the *Argo* passed safely between them (see ARGONAUTS). In ancient times the Symplegades were identified with the Cyanean Rocks, two small islands located near the entrance of the Black Sea.

**SYMPOSIUM**, among the ancient Greeks, a drinking party which followed a banquet and was accompanied by conversation either witty or serious. The historian Xenophon and the philosopher Plato each composed a narrative entitled *Symposium*, in which their teacher Socrates (q.v.) was one of the speakers, the subject of the discussion being the nature of love. Hence in modern times the term "symposium" is applied to a collection of opinions on a given subject.

**SYNAGOGUE**, a Jewish place of worship. The origin of this institution is probably to be traced to the Babylonian captivity. The synagogue represented in miniature the form of the temple, itself an enlarged type of the tabernacle; the faces of the congregation were turned toward Jerusalem. At the extreme eastern end was the ark, containing copies of the Pentateuch, from which the readings were chanted. In front of this was the stand of the public reader of the prayers, not far from which was suspended the ever-burning lamp. On a raised platform in the middle was the place of the reader or preacher. The women sat separated from the men by a low partition. The affairs of the Synagogue were administered by a board of ancients or elders, at whose head stood a chief or principal.

**SYNAGOGUE, THE GREAT**, a designation of the assembly described in Nehemiah 8-10, in the Old Testament. The 85 elders enumerated in Nehemiah 10:2-29 were supposed to have formed a body to whom the Law was transmitted from the prophets and by whom it was handed down to Antigonus of Soko. Tradition afterward increased their number to 120. Their labors were thought to have been completed in one generation, but according to the faulty chronology of later Jewish writers this generation covered the entire period from the return of the exiles to Alexander. Hence Zerubbabel, Jeshua, Nehemiah, and Mordecai are regarded as "men of the Great Synagogue", along with Ezra, the signers of the covenant, and Simon the Just. They are said to have written Ezekiel, Daniel, Esther, and the

Minor Prophets, which probably means that they edited and gave recognition to these books. The distinction between *midrash*, *halakoth* and *haggadoth* is ascribed to them, as well as the introduction of the Purim festival and the institution of the Shemoneh 'Esreh and the other prayers and benedictions. The spirit and tendency of their work is expressed in the sentence ascribed to them: "Be careful in pronouncing opinion; have many pupils; put a fence about the Law." When the chronological error was perceived, the Great Synagogue was conceived of as a permanent institution during the Persian period, and many more functions were assigned to it.

**SYNCHRONIZER**, a device used in electric-power stations for indicating when an alternating-current generator is operated at the same frequency as others with which it is desired to connect it in parallel in the same circuit; also for determining whether the voltages of two circuits are in phase with each other. It is called also a synchronism indicator or synchroscope, although this last term is applied to an instrument that shows whether a generator that is to be synchronized is running too fast or too slow.

**SYNCLINE**. See ANICLINE.

**SYNCOPATION**, in music, the joining together of two similar notes by means of a tie, so that the accent intended to fall on the second (strong beat) comes on the first (weak beat). The effect produced is that of *contratempo*. The effect of syncopation can also be produced by merely shifting the accent by means of *sforzando* marks. The North American Indians made extensive use of syncopation, and in this were followed by the Southern Negroes. In fact, the music of nearly every savage or semicivilized nation shows traces of syncopated rhythm.

**SYNCOPE**, swooning, with loss of sensation, motion, and consciousness. See FAINTING.

**SYNCRETISM**, a term derived from the habit attributed to the ancient Cretans of fighting fiercely amongst themselves, but combining resolutely against common external enemies. It came to be used of theological compromise, as between Catholics and Protestants, and between Lutherans and Reformed.

**SYNDIC**, an old term for a civil magistrate or officer representing a government or a community, who had different powers in different countries. At the University of

Cambridge the same name is applied to members of special committees of members of the senate appointed by grace from time to time for specific duties. In Italy the mayors of towns are called syndics.

**SYNDICALISM** (Fr. *syndicat*, "trade union"), generally, a form of revolutionary trade unionism. In another usage, adopted particularly in France, "syndicalism" signifies trade unionism in general; and revolutionary trade unionism is designated "revolutionary syndicalism" and is differentiated from reformist trade unionism, which is called "reformist syndicalism"; see **TRADE UNIONS**. In this article "syndicalism" is used in the sense of revolutionary trade unionism.

The distinctive feature of syndicalism is its conception of the role of trade unions. In reformist conceptions, unions are primarily instruments for improving the conditions of workers. Syndicalism regards them differently. The difference results from the partly socialistic and partly anarchistic nature of syndicalist doctrines. Syndicalism accepts the *Marxist* theory of the class struggle, and of its culmination in a social revolution and the establishment of a society based on the collective ownership of the means of production and distribution of wealth; see **MARX, KARL**, **SOCIALISM**. *Marxian Socialism*; **COLLECTIVISM**. With regard to the future collectivist society and the methods of struggle necessary to obtain it, syndicalism has been influenced by anarchist doctrines to so great an extent as to give rise to the term "anarchosyndicalism" as a designation of the syndicalist movement. Syndicalism thus rejects the Marxian concept of the proletarian dictatorship, and envisions a stateless society in which production will be conducted in order to satisfy the needs of the community and will be administered by a national federation of self-governing industrial unions and distributive associations of manual and mental workers.

In common with communists, syndicalists regard the struggles of unions in capitalist society to: better conditions, higher wages, and shorter hours primarily as skirmishes in which workers gain experience in class warfare and insight into their role as the "gravediggers" of capitalism and the creators of a more equitable society. The syndicalists advocate a policy of "direct action" in the form of strikes (and, formerly, also sabotage) against employers, and principally in the form of mass demonstrations against the state. They reject such political forms of

struggle as participation in elections, when they regard as tending to divert the workers from revolutionary methods of struggle; and they also reject political forms of organization, particularly political parties. In their view, the principal instrument of revolutionary struggle is the industrial union and the culminating act of the revolutionary struggle is the general strike; see **STRIKE**.

Syndicalist doctrines were first formulated about 1870 by members of the International Workingmen's Association (q.v.) or First International. Subsequently they were shaped in part by followers of the Russian anarchist Michael Bakunin (q.v.). They were given their characteristic content in France between 1895 and 1904 by a group of Socialist intellectuals, among whom Georges Sorel (q.v.) was outstanding, and by a number of the leaders of the *Confédération Générale du Travail* ("General Confederation of Labor"). Syndicalism grew rapidly in France between 1906 and 1910. The syndicalist movement also developed in other countries, particularly in Italy and Spain, and to a lesser degree in Latin America; it influenced the development of the labor movement in England; see **GUILD SOCIALISM**. The *Industrial Workers of the World* (q.v.), organized in the United States in 1905, is also regarded as a syndicalist organization.

The outbreak of World War I interrupted the growth of the syndicalist movement, but syndicalism enjoyed a rapid increase in influence during the period of disturbance in Europe immediately following the war. In Spain, the anarchist syndicalist trade union federation *Confederación Nacional de Trabajo* ("National Confederation of Labor"), outstripped an earlier, socialist-dominated union federation. However, following defeats in a number of important struggles, the syndicalist movement declined. Among these struggles were important strikes conducted by the syndicalist unions in France and Spain in 1920, and the seizure in northern Italy in 1921-22 of factories by workers largely under anarchosyndicalist leadership. Another vital factor in the decline of syndicalism was the formation of the Third (Communist) International (q.v.) in 1919, which attracted thousands of anarchosyndicalist workers and their leaders. The Spanish movement, however, continued to grow; after the revolution of 1931, which established the republic (see **SPAIN: History**), the *Confederación* had a membership of about 1,000,000 members, and comprised virtually

90 percent of the membership of the international syndicalist organization founded in 1922. The Spanish syndicalists participated with their own militia formations against the fascists during the civil war of 1936-39; virtually all its members were exterminated following the fascist victory.

**SYNERGISM**, the name given to a doctrine of theology which teaches that in the work of conversion the will of man is not wholly passive, but can co-operate, through consent, with the Divine Spirit. In the time of the Reformation Melancthon and his school were inclined to this view, while the strict Lutherans opposed it and charged its advocates with favoring Pelagianism.

**SYNESIUS**, a Neo-Platonic philosopher and Christian bishop, born in Cyrene in Lybia, and educated in Alexandria. His life illustrates the combination of Neo-Platonism and Christianity characteristic of the fourth century. Synesius was made Bishop of Ptolemais in 410, against his own desire, and with the apparent stipulation that he should not be obliged to give up his wife or his philosophy, but he administered his see with fidelity. Neither the time nor the place of his death is known. Synesius' writings include about 150 letters; *Egyptian Tales*, or *on Providence*, a sort of historical allegory of the providential government of the world; a defense of the philosophic life, *Dio* (after Dio Chrysostom); a humorous work, called *Praise of Baldness*, suggested by Dio's *Praise of Hair*; and ten *Hymns*, partly pagan and partly Christian. His character is well portrayed in the English writer Charles Kingsley's novel *Hypatia*.

**SYNESTHESIA**, in psychology, a form of imagination (q.v.) in which the stimulation of one of the senses evokes a simultaneous secondary sensation or image in another of the senses which has not been externally stimulated. One of the commonest forms of synesthesia is *colored hearing* (q.v.) or *chromesthesia*, by which an individual hearing a specific sound simultaneously sees a particular color; in well-developed cases of chromesthesia the special sound heard is always accompanied by the same imagined color perception. Letters of the alphabet and musical notes are among the commonest sounds provoking this phenomenon. Psychologists have been particularly successful in devising reliable tests for the measurement of chromesthetic tendencies in individuals; in one test, a person who saw violet when hearing the musical note D, experienced

the same combinations of sensations when tested seven years later. Color sensations are similarly associated by a few individuals with various tastes and smells, resulting respectively in colored tastes and colored smells. Among other manifestations of synesthesia are *number forms* in which an individual sees certain numbers in various geometrical patterns, and *date forms* in which dates, such as the months of the year, may be seen in such patterns as a closed ellipse. Most psychologists now believe that synesthesia is a learned rather than an innate reaction, and that the learning process begins early in childhood. In colored hearing, for example the patterns which the colors assume are usually closely related or identical to other patterns familiar to an individual during his childhood. Among the more common of these colored patterns or designs are wallpaper patterns, lampshade designs, and designs appearing on toys.

**SYNGE**, JOHN MILLINGTON (1871-1909), Irish dramatist, born in Newton Little, near Dublin. He became one of the leaders in the movement for the revival of the ancient language and legends of Ireland. He is chiefly identified with the national drama of the Abbey Theater, Dublin, and wrote a number of plays, among which are *Riders to the Sea*, *The Shadow of the Glen*, *The Playboy of the Western World*, and *The Tinker's Wedding*. Everything of Synge's which his literary executors thought worthy of inclusion is contained in his *Works* (4 vols., Dublin, 1910).

**SYNGE**, RICHARD LAWRENCE MILLINGTON (1914- ), British biochemist, born in Liverpool, and educated at Winchester College and Cambridge University. Between 1941 and 1948 he was successively with Wool Industries Research Association, in Leeds, and the Lister Institute of Preventive Medicine of the University of London. He joined the biochemical staff of the Rowett Research Institute, at Buckshorn, Aberdeenshire, in 1948. In 1952 Syngé was cowinner with the British biochemist Archer John Porter Martin (1910- ) of the Nobel Prize for chemistry for their discovery of the chromatography process, a method of identifying and separating chemical compounds.

**SYNODONTIDAE**, a family of malacopterygian fishes, especially those with supramaxillaries aborted and no phosphorescent or pearly spots. The family includes the lizard fishes.



**SYNONYM**, a word which nearly coincides in meaning with another. There is in most cases a slight individual shade of meaning in each synonym. Development of synonyms is one first of convergence and then of divergence, but the meanings are originally quite distinct. The main stylistic use of synonyms is to give variety and accuracy of diction.

**SYNOVIAL MEMBRANE**, a membrane which facilitates the gliding of a tendon of a muscle or of the integument over a projection of bone. See **JOINTS**.

**SYNOVITIS**, inflammation of a synovial membrane. Although inflammatory processes involving joints frequently start in an inflammation of the synovial membrane, they rarely confine themselves to this membrane but involve surrounding tissue. For this reason the term 'synovitis' which properly means inflammation of the synovial membrane only has been to some extent displaced by the term 'arthritis' which signifies inflammation of the joint in general including the synovial membrane.

**SYNTAX**, that part of grammar which treats of the rule for the formation of the sentence. It treats of the location of word and sentence in connected prose, of their arrangement and relative position required by grammatical connection, of apposition and cleavage of expression. See **GRAMMAR**.

**SYNTONIN**, a protein substance prepared by the action of dilute acid on the myosin of the muscle.

**SYPHILIS**, a chronic infectious systemic usually venereal disease caused by a spirochete or corkscrew-shaped bacterium *Treponema pallidum* in the same genus as the organism producing yaws (yaws). The disease if untreated causes destructive changes in all the tissues of the body, especially in the circulatory and central nervous system and often results in death.

**History**. Syphilis has been known to the civilized world since the end of the 14th century, when severe epidemics ravaged Italy. Many medical historians believe that the disease was carried from the New World to Europe by sailors of Columbus's fleet, others believe that the disease occurred sporadically in Europe prior to the 15th century, being first recognized as an entity during the Italian epidemic. Early syphilis epidemics were extremely virulent and almost always resulted in eventual death, later epidemics were milder, the causative

organisms being 'weakened' after passage through numerous human hosts each of whom developed resistant antibodies, see **IMMUNITY**. The cause of syphilis was unknown until 1905 when the German biologist Fritz Schaudinn discovered the specific bacterium responsible for the disease. A blood test for the diagnosis of syphilis was devised by the German bacteriologist August von Wassermann in 1906, the Japanese-American bacteriologist Hideyo Noguchi at the same time succeeded in obtaining pure cultures of the syphilis organism, and devised a skin test for syphilis. The German chemist Paul Ehrlich is famous for his discovery in 1908 that arsphenamine or salvarsan (914) could be used in the treatment of syphilis. Arsphenamine and its derivatives were successful in curing only a small number of cases of syphilis, and have the disadvantages of being toxic and of requiring years of continuous expensive administration. Mercury bismuth and iodides which have also been used in the treatment of syphilis, have the same disadvantages.

For this reason and because it is well known that 90 to 95 percent of the cases of syphilis in adults are transmitted by sexual contact, causing a social stigma on individuals afflicted with the disease, the prevalence of syphilis in the population of the United States showed only a negligible decrease after Ehrlich's discovery. Until 1936, mention of syphilis on the radio in newspapers and in public forum was considered immoral and objectionable by the general public. In 1936 newly appointed Surgeon General of the United States Public Health Service Thomas Parran Jr. provoked considerable controversy over the refusal of radio networks to grant him permission to discuss the effects of syphilis on American health. This controversy terminated in the first presentation of the social problem and community problem aspect of syphilis to the American people, radio stations and newspapers for the first time conducted programs designed to educate the people in the nature of the disease. Parran's work resulted in extensive dissemination of knowledge concerning syphilis, and in the participation of Federal and State public health authorities in wide programs of syphilis control. The development during World War II of the new antibiotic, penicillin, which seems able to cure syphilis, in early stages at least, within a week has also resulted in the cooperation of infected individuals who

no longer face a regimen of cure lasting several years. At the present time, about ten percent of the population of the United States still suffers from syphilis.

**Forms of Syphilis.** Syphilis may be either *acquired* or *congenital*. Congenital syphilis is discussed in a separate section below. Less than ten percent of the cases of acquired syphilis are infected nonvenereally; such cases may be infected by kissing syphilitics or by coming into close contact with eating utensils or bathroom equipment used by a syphilitic. The spirillum of syphilis enters the human body through minute abrasions in the skin or mucous membranes. The incubation period of the disease ranges from five days to four months after infection, with the greatest number of cases developing symptoms after twenty-six days. After the incubation period, *primary syphilis* ensues. This condition is characterized by the presence, usually on the genitals, of a hard *chancre* or painless, elevated ulcer from which exudes a thin, highly infectious secretion. This secretion contains numerous syphilis organisms which can be observed only under the dark-field microscope, which employs illumination from the side rather than from below. During primary syphilis, the Wassermann blood test for syphilis is usually negative.

Approximately six weeks after the appearance of the chancre, which has meanwhile disappeared, *secondary syphilis* begins. This condition is ushered in by an extensive rash which spreads over the skin and mucous membranes, and which may resemble any of the numerous varieties of dermatitis. The rash causes no discomfort and may persist for weeks or months. Constitutional symptoms, such as sore throat, headache, slight fever, and enlargement of the superficial lymph nodes, occur in less than fifty percent of persons with secondary syphilis. The Wassermann reaction is usually positive in this period.

A *latent period* or *asymptomatic period* occurs after the disappearance of the rash. This latent period may last only several weeks or may extend over a period as long as forty years. At the end of the latent period, *tertiary syphilis* ensues. This condition is characterized by the formation on the skin and in the internal organs of tumor-like masses known as *gummata*, and by inflammation of the arteries, especially the aorta and the arteries of the heart, and of the membranous sheaths covering the spinal

cord and brain. These characteristics are not invariable, persons suffering circulatory damage often not presenting symptoms of nerve damage and vice versa. Damage to the central nervous system occurs in only about six percent of all cases of uncured syphilis. The two most common manifestations of syphilitic nerve damage are *tabes dorsalis* and *general paresis*.

**Tabes Dorsalis** This condition, also known as *locomotor ataxia* and *posterior spinal sclerosis*, is characterized by the degeneration in the spinal cord of the nerve tracts which carry tension impulses from the muscles to the brain; see KINESTHESIS. Loss of the sense of muscle tension results in lack of awareness of muscle position; tabetics walk with unsteady, uncoordinated, floundering movements. In addition, they are usually subject to shooting pains, to loss of control over the anal and urinary sphincters, and to loss of proper reflexes. On the average *tabes dorsalis* occurs seven times as frequently in syphilitic men than in syphilitic women. The blood Wassermann reaction is positive in only about two thirds of the cases of *tabes dorsalis*, but the Wassermann reaction on spinal fluid is positive in all cases.

**General Paresis or Dementia Paralytica.** Syphilitic infection of the brain results in the development of paralytic foci over the body, and is characterized by tremors of the tongue, lips, eyelids, and extended fingers, and by disturbances of speech. The form of insanity known as *general paresis* sometimes accompanies the somatic symptoms of syphilitic brain infection, usually being precipitated by excess consumption of alcohol or by a blow on the head. Paralytic insanity may resemble any of the psychoses or psychoses (see PSYCHOLOGY, ABNORMAL), and usually terminates in complete intellectual and emotional deterioration and dementia. The blood Wassermann in cases of paresis is almost always positive. Paresis occasionally occurs together with *tabes dorsalis*. About fifteen percent of all persons admitted to mental hospitals in the United States are paralytics.

**Congenital Syphilis.** Syphilis is almost always transmitted from an infected woman to the fetus she bears. In women having syphilis before pregnancy, or contracting the disease at the time of conception, the child is rarely born alive; in cases of live births, the infants usually die shortly after birth. In women contracting syphilis late in

the gestation period, live children are often born; sometimes these children show symptoms of the disease at birth, and sometimes the disease is latent in these children for as many as twenty years. Children with congenital syphilis often present the following symptoms: upper incisor teeth with V-shaped cutting edges; "saddlenose", a typical deformed appearance of the nose; and impairment of vision. Congenital syphilis are also often dead. About one third of all congenital syphilis develop damage to the central nervous system, juvenile paresis, juvenile tabes dorsalis, epilepsy, and various degrees of mental deficiency occur in congenital syphilis.

Because of the danger of congenital syphilis, many States of the U.S. have enacted laws preventing the marriage of persons infected with syphilis. Almost two thirds of the States require a blood examination for syphilis before granting a marriage license; several States which do not specifically require a blood test do request a physical examination of the prospective groom before marriage. Persons with syphilis may not be allowed to marry until as long as three years after treatment has resulted in a negative Wassermann reaction. Ten States, including several States which do not require premarital blood tests for syphilis, have laws requiring blood tests of all pregnant women.

**Treatment.** Early syphilis can be cured and transmission of syphilis from women to their children can be prevented by injections of large doses of penicillin. In more advanced cases of syphilis, injections of penicillin, mephaesin (oxophenarsine hydrochloride), and bi-muth subsalicylate have proven effective. Syphilis affecting the central nervous system can often be cured by subjecting the patient to *fever therapy*, by injecting malarial organisms and allowing the patient to suffer several attacks of malaria, or by diathermy. Fever therapy halts the development of the disease in the nervous system but cannot repair nerve tissue already damaged.

**SYRA, HERMOUPOLIS, or HERMOPO-LIS**, seaport on the island of Syra and capital of the Greek department of Cyclades (q.v.). The island, about 10 m. long and 5 m. wide, is the largest of the Cyclades group in the Aegean Sea, and lies 13 miles s. of Andros, the most northerly of the Cyclades. The coastline is irregular and the surface of the island is rugged and barren. The principal industry is agriculture. Crops include cotton,

wheat, figs, and wine grapes. Sheep and goats are raised and wine is produced. Hermoupolis, the principal city on Syra, and the seat of a bishopric, is situated on a bay on the E. coast. Its principal industry is trade. Area of island, 42.5 sq.m.; pop., about 30,000. Pop. of Hermoupolis (1951) 16,953.

**SYRACUSE**, county seat of Onondaga Co., N.Y., situated at the s. end of Lake Onondaga and on the New York State Barge Canal, 167 miles w. of Albany. It is served by three railroads and maintains a municipal airport. The city is surrounded by a fertile agricultural area, and is within a short distance of several of the most popular vacation-resort areas in New York State. The principal industries in the city are the manufacture of steel, air-conditioning equipment, pneumatic-tube and conveyor systems, electric conduit fittings, agricultural implements, typewriters, washing machines, clothespressing machines, cans, pottery, chinaware, furniture, shoes, clothing, candles, and mince meat. In the vicinity of the city is a vast plant producing soda ash, caustic soda and potash, chlorine, and potassium carbonate. Among the educational and cultural institutions are Syracuse University (q.v.), which includes the New York State College of Forestry; a city normal school; LeMoyne Junior College; a school of aviation; the Syracuse Museum of Fine Arts; the Onondaga Historical Association; the public library, containing collections of old manuscripts and a special collection of Walt Whitman, and the Music School Settlement, at which eligible children receive free instruction. The Syracuse Medical Center contains a group of hospitals and the Syracuse University Medical School. Syracuse is the site of the New York State Asylum for Feeble-Minded Children, and of the New York State Agricultural and Industrial Exposition, which has been held there annually since 1890, the grounds are extensive and contain many exhibition buildings, including a coliseum seating 7500 persons. Points of interest in the city and vicinity include the First Baptist Church, an imposing ecclesiastical structure which also contains the Mizell Hotel, built around and above the church, the municipal zoo, the Mills Rose Garden, and the Onondaga Indian Reservation.

The region of Syracuse, visited by the French explorer Samuel de Champlain in 1615, contained at that time the capital of the Five Nations of the Iroquois, and was

the home of the Onondago Nation. French priests founded a mission near the present city in 1655 and built a fort. Both were abandoned in 1658 because of the hostility of the Indians; the mission was re-opened in 1668. Salt springs, which had been discovered there in 1654 by Simon le Moine, a Jesuit missionary, were the attraction that finally brought about permanent settlement of the site, about 1797. Syracuse developed as a salt-manufacturing center and was incorporated as a village in 1825, becoming the county seat in 1827. In 1847 Syracuse and Salina, another salt-manufacturing center, were combined and chartered as a city, with additional villages being annexed later in the century. The salt industry of Syracuse, which once supplied most of the salt in the U.S., declined in the late 19th century, at which time many of the city's present diversified industries were established. The original salt spring, a replica of the early mission, and a salt museum are maintained as monuments to the founding of the city. Pop. (1950) 220,583.

**SYRACUSE** (It. *Siracusa*), the most famous and powerful city of ancient Sicily, situated on the s.e. coast of the island, about 33 miles s.s.e. of Catania. It was founded by colonists from the Greek city of Corinth in the 8th century B.C. The original settlement was on the island of Ortygia which lies near the shore, but soon extended to the mainland.

In 485 B.C. Gelon (q.v.), tyrant of Gela, made himself master of Syracuse, which then became the seat of his government. He was a wise and able ruler, beloved by his people, and is famous for his victory over the Carthaginians at Himera in 480 B.C. Gelon was succeeded by his brother Hiero I (q.v.), who ruled from 478 to 466 B.C. and was celebrated throughout the Greek world as a patron of the arts. Among the famous Greek poets who spent some time at the court of Hiero were Æschylus, Pindar, Simonides of Ceos, Bacchylides, and Epicharmus. In 466 B.C. the democrats expelled Hiero's brother and successor, Thrasybulus, and for sixty years Syracuse enjoyed a free and democratic government. Hostilities with Segeste (q.v.) led in 415 B.C. to the great two-year struggle with Athens in which the Syracusans, aided by the Spartan general Gylippus, annihilated the invading Athenians and contributed decisively to the final outcome of the Peloponnesian War.

The conquests of Carthage in Sicily to-

ward the close of the 5th century B.C. threatened the existence of Syracuse, but under the successful leadership of Dionysius (see **DIONYSIUS THE ELDER**), who became tyrant of the city in 405 B.C., it developed into the chief power of Magna Græcia and Sicily. Dionysius ruled until 367 B.C., maintaining the state's strength, but the reigns of Dionysius the Younger and of Dion (q.v.) were unsettled. After the overthrow of the tyranny and the restoration of public liberty in 343 B.C. by Timoleon (q.v.), a brief period of tranquillity ensued. In 317 B.C. Agathocles restored the despotic form of government, which continued, with one interruption through the reign of Hiero II (q.v.). Hiero II was, after 263 B.C., a faithful ally of Rome against the Carthaginians, but upon his death in 215 B.C. the pro-Carthaginian party seized control of the city. The Romans, led by their consul Marcus Claudius Marcellus (q.v.), besieged Syracuse in 214 B.C., and, although city's defenses had been strengthened by the machines of Archimedes (q.v.), it was captured and sacked in 212 B.C. Under Roman rule Syracuse declined, although it continued to be the capital and first city of Sicily. It was captured, pillaged, and burned by the Saracens in 878 A.D., and after then sank into complete decay.

The modern city of Syracuse is the capital of the province of the same name, and is located 54 m. by rail s.e. of Catania. The city is confined to the original limits of Ortygia, now a peninsula. The mainland contains the chief remains of the ancient city's splendor, including a fine rock-cut theater, a Roman amphitheater, the great altar of Hiero II, the remains of ancient fortifications, and the famous quarries in which the Athenian prisoners were confined in 413 B.C. The modern city is an important port; the chief exports are the agricultural products of the surrounding region, notably olive oil and citrus fruits. During World War II Syracuse was bombed by the Allies and occupied by Allied forces in 1943 (see **SICILY: History**). Pop., about 53,000.

**SYRACUSE UNIVERSITY**, a privately controlled, coeducational institution of higher learning, situated at Syracuse, N.Y. It was founded in 1849 at Lima, N.Y., as Genesee College; the institution was moved to Syracuse in 1869, and chartered under its present name in 1870. Courses are offered in the liberal and fine arts, medicine, law, applied science, education, library service, public speech and dramatic art, nursing, home

economics, business administration, journalism, forestry, and public affairs, leading to undergraduate and graduate degrees. An accelerated course of two years and eight months, leading to the bachelor's degree, is available in some departments. The University also has three affiliated colleges: Triple Cities College, at Endicott, N.Y.; Utica College, at Utica, N.Y.; and University College, one mile from the main campus in Syracuse. In a recent year the total enrollment was over 19,000, and the faculty comprised about 1750 members. The library contained about 365,000 volumes.

**SYR DARYA** (Turki, *Sir Darya* or *Saihun*; anc. *Jaxartes*), a large river in the Asiatic portion of the Soviet Union. The Syr Darya rises as the Naryn in the Tin Shan mountains of the Kirghiz S.S.R., and flows in a generally northwesterly direction for approximately 1500 m. until it enters the northeastern part of Lake Aral in a shallow, marshy delta. The river is utilized for navigation. Along many points of the Syr Darya navigation is difficult.

**SYRIA**, a republic in w. Asia, bounded on the n. by Turkey, on the e. by Iraq, on the s. by Jordan and Israel, and on the w. by Lebanon and the Mediterranean Sea. The capital and largest city of Syria is Damascus (q.v.); other important cities include Aleppo, Homs, and Hama (q.v.). The terrain is chiefly a limestone plateau, its belts of highlands extending generally from n. to s. On the Syrian-Lebanon border extend the Anti-Lebanon Mts. The Syrian plateau is traversed by a great depression, the Rift Valley, which divides the country into two comparatively narrow stretches of tableland, the e. portion merging into the Syrian desert. In the s. e. is the mountainous region known as the Djebel Druze. The Euphrates R., entering Syria at the Iraq border, flows diagonally across the country to Turkey, and the Orontes R., rising in the Anti-Lebanon Mts., flows n. and then w. to the Mediterranean Sea. The Syrian climate is subtropical, with a 75°-100°F. range at Aleppo in summer and a 32°-50°F. range in winter. Annual rainfall averages from 10 to 20 in. Area, about 54,300 sq.m.; pop. (1950 est.) 3,252,687.

Syria is principally an agricultural country, with about 17,000 sq.m. under cultivation and 15,000 additional sq.m. arable. Wheat and barley are the leading grain crops, and tobacco, olives, fruits, vegetables, and hemp are grown. The raising of silkworms and

stock raising are important. Syrian industries include the manufacture of cement, textiles, soap, leather, and canned goods. Most of the population is composed of Arabs (including 300,000 Bedouins), with Kurdish, Armenian, and other minorities. The overwhelming proportion of the population (80%) is Sunni, or orthodox, Moslem, and Arabic is the principal language. Christians in Syria comprise about 14% of the population and Druses (q.v.) comprise about 3%. Primary education for children is free and compulsory. The Syrian school system included, in a recent year, over 1700 primary schools (one eighth privately owned) attended by approximately 260,000 pupils, and about 135 secondary schools (about half private) with 28,000 pupils. A Syrian university is located at Damascus, and various schools are maintained by foreign organizations. Communications include over 500 m. of railroad, owned by three private companies, and about 9700 m. of road. International airlines have stations at Damascus. The Syrian president is elected by the chamber of deputies for a five-year term. In conjunction with his cabinet he is responsible to the chamber. Deputies are elected for four-year terms.

*History.* As early as the 16th century B.C. the region now Syria was the home of an advanced culture, principally influenced by Egypt and Babylon. Parts of the region were conquered successively by the Egyptians and the Hittites, and in the 8th century B.C. Syria was conquered by Assyria. In the 6th century B.C. the region was conquered by the Chaldeans, passed to Persia in 538 B.C., and was taken by Alexander the Great of Macedon in 333-32 B.C. At the close of the 4th century B.C. Syria was appropriated by Seleucus, one of Alexander's generals, who founded Antioch as his capital. During the 3rd century B.C. the Ptolemies of Egypt and the Seleucids contended for the possession of lower Syria. The entire area, and much of w. Asia, passed to the Seleucids (q.v.), whose realm came to be known as the kingdom of Syria. In 64 B.C. Syria was made a Roman province. At the dissolution of the w. Roman Empire in the 5th century A.D., Syria became a part of the Byzantine Empire. As a Byzantine province it was conquered in 636 by the Mohammedans, and in 661 Damascus became the seat of the Moslem caliphate; later the city was supplanted by Baghdad in present-day Iraq.

The possession of the Syrian region, then including Jerusalem, engendered the first



Ewing Galloway

*Top A street in the city of Damascus, capital of Syria Bottom A dealer in cactus fruit in Damascus, where a large portion of retail trade is transacted on the street*



Fwink Galloway, Alice Schalek from Black Star

*Top: Syrian villagers near beehive-shaped homes Bottom On a street in Aleppo, Syria*

Crusade, and in 1099, the Crusaders incorporated part of the region into the Christian kingdom of Jerusalem; and part of it in the principality of Antioch. In a subsequent campaign (1174-87) Saladin, sultan of Egypt, took Syria and overthrew the kingdom of Jerusalem. The many wars centering on Syria impoverished the land and its people, and its ruin was completed by a Mongol invasion in 1260. The Ottoman Turks incorporated the region into their empire in 1516, and it remained in their possession for the next four centuries. Under Turkish rule, the province of Turkey incorporated the territory now Lebanon, Syria, Jordan, and Israel (q.v.). The commercial importance of the territory as the site of overland routes to the Orient vanished with the opening of the Suez Canal in 1869.

During World War I British and Arab forces entered Damascus on October 1, 1918, and Turkish forces were routed on the following day. Following the war, Great Britain, in 1919, relinquished control of the region to France, which in 1920 was given a League of Nations mandate over Syria, then including also Lebanon. Syrian nationalists had begun to agitate for complete independence before the assignment of the mandate, and during the era of French control they continued to rebel and instigate riot. During World War II British and Free French forces invaded Syria, and in 1941 it was declared an independent republic. Administrative powers were transferred to the Syrian republic in 1944, and the occupying troops left the country in 1946. Syria became a charter member of the United Nations. Nationalistic ambitions converged, in 1944, in a "Greater Syria" movement, instituted to found a Syrian Arab state including Lebanon, Syria, Trans-Jordan, and Palestine, a recreation of the province as it was constituted under Turkish rule. This movement gave impetus to Syrian adherence to the Arab League (q.v.), formed primarily to prevent the creation of a Jewish state in Palestine. Syrian forces participated in the invasion (1948) of newly established Israel (q.v.). On March 30, 1949, a military junta led by Gen. Husni Zayim seized power. Essentially a dictatorship and highly unpopular, the new regime was overthrown (August) by another military junta, and Zayim was executed. In July Syria and Israel concluded an armistice. General elections were held in November for a constituent assembly. A third *coup d'état*, led by Col. Adib Shishakli, occurred in De-

cember. The constituent assembly promulgated a new constitution in September, 1950, and, assuming responsibility as the chamber of deputies, elected the provisional chief of state Hasham el Atassi to the presidency.

Syrian and Israeli frontier forces clashed on numerous occasions in the spring of 1951. The hostilities, which stemmed from Syrian opposition to an Israeli drainage project in the demilitarized zone between the two countries, ceased on May 15, after intercession by the U.N. Security Council. Successive governmental crises during 1951 culminated (Nov. 29) in another *coup d'état* engineered by Col. Shishakli, commander in chief of the army. President Atassi resigned shortly thereafter, and Shishakli and his associates formed a government with Col. Fawzi Silo as chief of state and premier. In January, 1952, the new regime announced plans for a land-reform program providing for the distribution of about 4,000,000 acres of state-owned lands to landless peasants. Col. Shishakli was elected president of Syria without opposition in July, 1953. According to official sources he received 99.6 percent of the votes cast. In the same election the voters approved a new constitution, which extends voting rights to women and authorizes the land distribution program.

#### SYRIAC LANGUAGE AND LITERATURE.

The Aramaic dialect of Edessa and western Mesopotamia, in which many literary productions have been preserved. The Syriac language shows in its earliest documents a remarkably fixed type, and must therefore have been long spoken in Mesopotamia.

At Ras Shamra, southern Syria, F. A. Schaeffer unearthed, in 1931, an ancient city of the twentieth century B.C. Cuneiform inscriptions on terra cotta tablets have proved to be the world's earliest dictionaries of unknown tongues.

There was probably an extensive pagan literature both in Edessa and in Harran, but the story of Achikar, an account of a water famine in 201 A.D. preserved in the Chronicle of Edessa, and the letter of Mara, son of Serapion, of the 2nd and 3rd century, seem to be the only extant specimens. The translation of the Old Testament was probably made by Jews. Two recensions of the oldest translations of the New Testament have been preserved in part in a Sinaitic manuscript of the Gospels and a Nitrian manuscript published by Cureton, containing fragments of the Gospels. The most flourishing period of Syriac literature extended from



about 400 A.D. until the Arabic conquest. In the course of the 5th century the great schism occurred which divided the Mesopotamian Church between Nestorians and Monophysites and severed both from the Catholic Church. An eminent poet of this century was Isaac of Antioch. Much of the early Nestorian literature is lost, but some works of Hamana (d. 607), Babai (d. 610), and Elias of Merv remain. After the Moslem conquest the Arabic language gradually gained on the vernacular. But Syriac still continued to be spoken in many localities and to be cultivated as a learned language. The use of two languages led to philological studies, and many works on grammar and lexicography were written. Among these may be mentioned the grammar of Elias of Tirhan and the lexicons composed by Bar Bahlul (963). Many books were translated from the Arabic in the 10th century, such as the *Kalilah wa Dimnah*, *Sindbad*, and Pseudo-Callisthenes' life of Alexander. Classical Syriac was written with great elegance by the Sabian Ithab ben Korran (d. 901) and his sons.

**SYRINGA.** See LILAC; MOCK ORANGE.

**SYRINX,** an organ peculiar to birds, concerned in the production of voice. It is usually composed of several modified rings of the lower trachea or upper bronchial tubes, the inner half of which are covered by a thin medial fold of membranous tissue. Special muscles control the tension of this membrane, and by thus varying the size of the aperture through which the air leaves the lungs, varying tones are made and controlled.

**SYRINX,** in Greek mythology, an Arcadian water nymph who fled from Pan (qv.), the god of forests and flocks, and was turned into a reed from which Pan made a set of pipes. Syrinx is also the name of a simple reed instrument, probably the most ancient of musical instruments, thought to be identical with the Hebrew Ugab mentioned in the Bible, and also called by the ancient Greeks a Panpipe. It was formed of seven, eight, or nine short, hollow reeds, cut in graduated lengths so as to produce a musical scale, which were stopped at the lower ends by natural knots in the reeds, and were fastened together.

**SYRLIN, SURLIN, or SIRLIN,** or JÖRG THE ELDER (about 1425-91), famous German wood carver and sculptor. The three-seated stool of 1468 at the entrance of the choir in the cathedral at Ulm and the stately double row of choir stalls (1469-74) there, exhibit a

plastic beauty and freedom of form unequalled by any contemporary effort. His earliest known work is a singing desk (1458) in the Ulm Museum, and as an isolated production in stone is to be mentioned the fountain in the market square, known as the "Fischkasten" (1482).

**SYRPHUS FLY,** a fly of the family Syrphidae, many species of which are of much economic importance. More than 300 species occur in the United States. They are stout-bodied flies and vary greatly in color. Many species closely resemble bees and wasps. Nearly all of them are flower flies and pollen carriers. Many syrphus flies in the larval state feed upon plant lice and other soft-bodied insects. Others live in decaying wood or in manure or soft mud, in the sap of trees or in the stems of plants, or in fungi, or as guests of ants and bumblebees. The rat-tailed maggot is an example of the forms found in soft mud or in manure. Those which live in ants' nests belong to the genus *Microdon* and are among the strangest insect larvae known.

**SYRUP.** See SIRUP.

**SYSTEM,** in geology, a division of rock strata deposited in the surface of the earth during specific periods of geologic time; see GEOLOG, SYSTEMATIC. When the normal deposition of rocks was altered by disturbances during a period, the system becomes subdivided into lesser units called *series*. Systems and series are usually named according to the areas in which they were first studied intensively. Thus, the Cambrian system, first uncovered in Wales, bears the Roman name of the area. The Cincinnati series likewise refers to the series exposed in the region of Cincinnati, Ohio. Several systems are named according to their structure rather than vicinity. Examples of these are the Cretaceous, or chalk system, and the Triassic, or threetold, system. In addition, the individual series comprising a system are often referred to as Lower, Middle, and Upper, according to their order of deposition in geologic time.

**SZCZĘCIN.** See STETTIN.

**SZÉCHENYI, COUNT ISTVÁN** (1792-1860), Hungarian statesman, born in Vienna. As a youth he served in the Austrian army in the wars against Napoleon, and afterward traveled. In 1825 he took his seat in the upper house of the Hungarian parliament. As a leader of the National Party he endowed the Hungarian Academy of Science,



(Left to right) Black Sea

*Ferryman placing a traveler's baggage on a raft at a river in Szechwan, China*

a conservatory of music and a theater. To his exertions were due the erection of the great suspension bridge between Pest and Buda, the improvement of navigation at the Iron Gate, the regulation of the Theiss River, and the introduction of steamboats on the Danube River. In 1847-48 he opposed the extreme measures of the Hungarian statesman Lajos Kossuth but later fell in with the popular movement and became a member of the ministry under Károlyi Batthyányi and Kossuth in 1848. Becoming insane soon after, he was taken to the asylum at Dobling, near Vienna, in which though he partly recovered he spent his remaining years. In March, 1860, his papers were searched by the police and in a fit of excitement he shot himself.

**SZECHWAN**, the most populous province of China, situated in the central section of the country and adjoining Kansu and Shensi on the N, Hupeh and Kwichow on the E, Yunnan on the S and Sikang and Chinghai on the W. The dominant feature of the terrain of Szechwan is the so called Red Basin, a plateau occupying the central part of the province. In the N, NE, E, and W, the Red Basin is fringed by ranges of hills and mountains. Severe earthquakes occasionally occur in Szechwan. The Red Basin,

a rich agricultural region is traversed by the Yangtze R. (qv) which flows in a north easterly direction through Szechwan and by a number of its tributaries, notably the Min, Kailing and Yalung rivers. A succession of narrow gorges and rapids characterizes the course of the Yangtze in N. Szechwan and the flow of its affluents is torrential in the mountainous areas. In the plateau region however the Yangtze and most of its tributaries are navigable, providing a valuable network of inland waterways.

Szechwan possesses a temperate climate with warm summers and moderately cold winters. January and August temperatures average about 49°F and 87°F respectively in the plateau region. Precipitation is largely confined to the period between March and September. The province contains an abundance of natural resources including vast tracts of alluvial lands, large forested areas and a variety of productive mineral deposits. Among the exploited mineral deposits are bituminous coal, iron, salt, copper, antimony, lead, silver, and gold. The most widespread species of tree is the tung, which yields a large volume of tung oil.

Farming is the most important industry of Szechwan. The major crops are grains, rice, tea, sugar cane, legumes, sesamum, citrus

fruits, hemp, and tobacco. Irrigation is extensively employed in the cultivation of certain crops, mainly rice and sugar cane. The manufacturing industries of Szechwan occupy a significant sector of the provincial economy. These industries include the manufacture of iron, steel, machine tools, electrical equipment, alcohol, drugs, and textiles. Transportation facilities in the province are limited to inland water and automotive carriers. There are no railways, and inland water communications with central China are prevented by the Yangtze rapids. The highway system, which provides connections with the adjacent provinces, recently totaled almost 4000 m.

The provincial capital is Chengtu (qv) and Chungking (qv) is the largest city. Other important cities are Wanchien (pop. about 85,000), Fowchow (pop. about 100,000), and Szeching (pop. about 100,000). Area 144,996 sq. m.; pop. (1955) 6,000,000.

**SZEGED**, a town of Hungary, at the confluence of the M<sup>3</sup> and the Tisza rivers, 115 miles S. of Budapest. In 1871 it was devastated by a flood when 1000 people lost their lives; the rebuilt town is now protected against inundations by a doubling of embankments. Szeged contains factories producing soap, spirits, match, soda, tobacco, coarse cloth, and carries on an extensive river trade in wood, corn, and wool. A peculiarity of the town is *paprika*, a kind of capsicum. Pop. (1941) 116,752.

**SZEKESFEHÉRVAR**, or **SECHUWESSEN**, a city of Hungary, 5 miles S.W. of Budapest. The manufactures of woollens, silks, and knives are extensive, and the agricultural interest prominent. From the 11th to the 16th century the kings of Hungary were crowned there. Pop. about 40,000.

**SZE-MA KWANG**, or **SSU-MA KUANG** (1019-86), distinguished Chinese statesman and historian, born in Hui district of Honan. At nineteen he entered the public service, rose rapidly, became president of the Huan Yu and a minister of state, failing to induce the emperor to dismiss Wang An-shih and repeal his reforms. Sze-ma retired to private life and devoted himself to the preparation of his *History of China* (405 B.C. to 960 A.D.) in 224 books, called the *Comprehensive Mirror for the Aid of Those Who Govern*. In 1085, on the death of the emperor, he was reinstated in office, and at once set about the repeal of the reforms of Wang, but he died the following year. He also wrote the *Ki ku lu* ("Investigations



Joseph Sze, etc.

into Antiquity") in twenty books, an etymology dictionary, and essays.

**SZE-MA TS'EN**, or **SZU-MA CH'EN** (145-85? B.C.), the first great historian of China, born in Lun-mun in Honan. He made good progress in learning while still a child, and when twenty began a great tour of the empire. On his return he was commissioned to inspect and report upon the regions now known as Szechuen and Yunnan, then recently conquered. In 110 B.C. he entered upon the task of compiling the great historical work which had been begun by his father. This he accomplished in 91 B.C. The work is entitled *Shih Ki* ("Historical Records") and in 10 books covers the history of China from 697 B.C. to 104 B.C.

**SZENTES**, a town of Hungary, 28 miles N. of Szeged, near the left bank of the Theiss. The inhabitants are chiefly engaged in the making of wine. Pop. about 32,000.

**SZENT-GYÖRGYI VON NAGYRAPOLT**, **ALBERT** (1895-) Hungarian biochemist, born in Budapest and educated at the University of Budapest and Cambridge University. He was professor of medical chemistry at the University of Szeged from 1930 to 1944. In 1945 he became professor of biochemistry at the University of Budapest. After

1947 he served as director of research at the Institute of Muscle Research of the Marine Biological Laboratories, Woods Hole, Mass. An authority on the biological process of oxidation, Szent-Gyorgyi is noted for his discoveries concerning ascorbic acid (vitamin C) and for his investigations of the muscle protein, actin. He was awarded the Nobel Prize for physiology and medicine in 1937. Among his writings are *Oxidation, Fermentation, Vitamins, Health, and Disease* (1939), *Muscular Contraction* (1947), and *The Nature of Life* (1948).

**SZIGETI, JOSEPH** (1892- ), Hungarian violinist, born in Budapest and trained at the Budapest Royal Academy at which he studied violin under Jenő Hubay (qv). He made his debut in his native city at the age of eleven. Subsequently he toured the continent and England and was widely acclaimed as an outstanding virtuoso. From 1917 to 1924 he conducted master classes in violin at the Geneva Conservatory of Music, Switzerland. He came to the United States in 1925 to appear as soloist with the Philadelphia Orchestra. After that time Szigeti appeared frequently in this country as guest artist with the leading symphony orchestras, and also on many national radio broadcasts. He wrote *With Symphonies* (1947).

**SZIGLIGETI, EDITARD**, pen name of JOSEPH SZATHMARI (1814-78), Hungarian dramatist, born in Grosswardein. He studied engineering, but in 1834 went on the stage at Buda and in 1837 became secretary and stage manager of the newly erected National Theatre in Pest. Of his numerous dramas several were awarded prizes by the Hungarian Academy, among them *Rosa Vándor Szemeszt* ("Itinerant Actors"), *Pal Beldi Lach Imre*, and *Bela IV*, but the greatest success attended his popular plays drawn from national life, many of which found their way also to the German stage, notably *The Deserter*, *Two Pistols for Csikós*, *The Foundling*, and others. Besides his excellent *A Drama of Valfajár* ("The Drama and Its Species," 1874) he published biographies of Hungarian actors (1875). He was elected a member of the Hungarian Academy (1860) and of the Kisludgy Society (1848) and in 1877 director of the National Theatre.

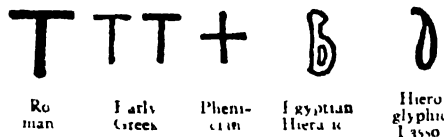
**SZOLNOK**, town in Hungary on the Theiss, 100 miles SE of Budapest. Pop. 10,000.

**SZOMBATHELY**, SZOMBATHELY, a city in Hungary, 65 miles SE of Presburg. Important industrially with paper, beet, and other factories, a cultural, machine, and steam plant. It has many beautiful arches with a museum in the 14th century. Pop. 10,000.



**T**, the twentieth letter of the English alphabet. It denotes the explosion made by checking the speech-current for an instant between the tip of the tongue and the upper gum, the vocal chords being inactive and the nasal passage closed. It is best called a "supradental voiceless mute." The corresponding voiced mute is *d*, the corresponding nasal is *n*.

The history of the characters is represented as follows:



The hieroglyph represents a lasso, the Phœnician a cross or mark of ownership (Ezek. 9:4). The Greek, Phœnician name is tau, the Roman *te*, whence English *t*. The rune is called *tîr* ("glory"), and is the seventeenth of the futhorc. T is the last letter of the Phœnician alphabet, naturally following s, and the favorite final mute.

For the dental fricatives *th*, as in *thin*, and *th*, as in *this*, Anglo Saxons used þ and ð borrowed from the runic alphabet. They represent the primitive Germanic *th* which resulted from Indo-European *t* after the first mutation *three*, *thunder*, *frather*. But

English *th* often represents the Greek *θ*, which was an aspirated *t* (somewhat as in *hothouse*). The Romans wrote it *th*, and then dropped the aspiration, so that, in mediæval Latin as in the Romance languages, *th* is simply another way of writing *t*. Italian and Spanish have discarded this *th* with the *t* sound, but French keeps it. In English the Greek-Latin *th* was early merged with the Germanic *th* and the new sign drove out the old letters þ and ð.

The letter T is used as an abbreviation in music for *tasto*, *tempo*, *tenor*, *tutti*; nautically, for *thunder* as recorded in logbooks; in personal names such as Thomas and Theresa, in *taw*, for Trinity term, and *thiet*, formerly branded on the hand of a criminal; in Great Britain it denotes *Taxed* (stamped on letters to indicate that there is postage to pay).

It is employed as a symbol in mathematics denoting time, tensor, in Roman notation it denotes the number 160; with a dash over it, 160,000; it denotes the nineteenth (or twentieth when J is the tenth) in a class, order, group, or series, nineteen (or twenty) as a number or numeral; also surface tension.

**TAAFFE**, COUNT EDUARD (1833-95), Austrian statesman of Irish extraction, born in Prague. He entered the public service in 1857 and was appointed governor of Salzburg in 1863. He afterward held several

ministries until 1871, when he was made governor of Tirol and Voralberg. In February, 1879, he was appointed minister of the interior, and in August he formed a new cabinet, over which he presided until 1893, when a radical electoral reform measure which displeased all parties compelled him to retire.

**TAAL**, a pueblo or municipality of Batangas Province, Luzon, Philippine Islands, on the Pansipit River, 50 miles S. of Manila, on the Bay of Balayan. It is situated in a district which produces rice, Indian corn, sugar cane, cacao, and cotton. Livestock is reared, and the town has a shipping trade. Pop., about 33,000, including a large number of Chinese.

**TAAL**, the patois spoken by the Dutch in South Africa, a degenerate form of the language of the first settlers from Holland.

**TABACO**, a pueblo or municipality of Albay Province, Luzon, Philippine Islands, 20 miles N. of Albay, on Tabaco Bay. Hemp, cloth, baskets, and mats are produced. It has a considerable shipping trade. Pop., about 24,000.

**TABANIDAE**. See HORSEFLY.

**TABARD**, a heavy outer coat of rough cloth once worn by poor people; also, a loose cloak without sleeves worn by knights over their armor. The name was given to a 14th-century inn located in High Street, Southwark, which was the starting place for the pilgrims mentioned by Chaucer when they set out upon their journey to the shrine of Thomas à Becket. The sign of this London inn was a tabard or sleeveless jacket.

**TABARI**, or (Arabic) *Abū Ja'far Muḥammad ibn Jarīr al-Tabarī* (838-923), Arabian historian and theologian, born in Tabaristan, Iran. He studied in Baghdad, and in Syria and in Egypt. He wrote the first universal history in Arabic. His great historical work is the *Annals*, a history of the world from the creation to 914 A.D.; this was published in Leyden (1879-1901) in 15 volumes. He also wrote an extensive commentary on the Koran, superior to all others, which was published (1902-03) in Cairo, in 31 volumes.

**TABASCO**, a maritime State of Mexico. It has no railways, nor any good roads. The climate is hot and unhealthy and the rainfall very abundant. Agriculture is the leading industry, and the fertile soil produces sugar, cacao, rice, rubber, coffee, corn, and fruits. Villa Hermosa is the capital. Area, 9782 sq.m.; pop. (1950) 351,106.

**TABASHEER**, a white siliceous substance sometimes found in the cavities or tubular parts of the stems of bamboos and other large grasses. It is in high repute among the Hindus as a tonic, and is prepared by imperfect calcination and trituration. It is remarkable as having the lowest refracting power of any known substance.

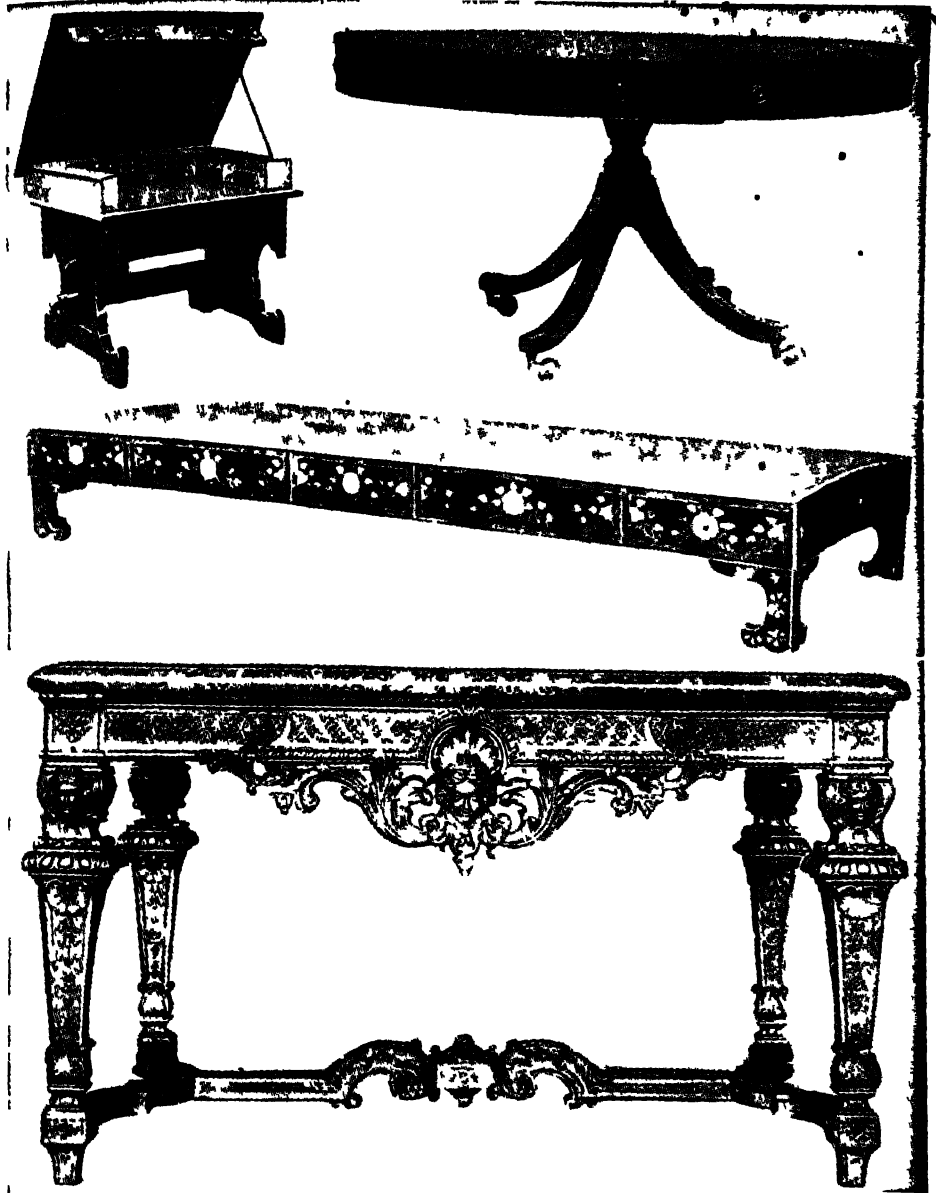
**TABB**, JOHN BANISTER (1815-1909), Roman Catholic priest and poet, born in Amelia County, Va., and educated privately. During the Civil War he served on a blockade runner. He was graduated from St. Charles College, Ellicott City, Md., in 1875, ordained priest in 1884, and subsequently taught English grammar in his Alma Mater. Among his works are *Poems* (1884), *An Octave to Mary* (1893), *Poems Grave and Gay* (1899), *Two Lyrics* (1900), and *Later Lyrics* (1906).

**TABERNACLE**, the tent in which the Ark of the Covenant was conveyed. It seems (1 Sam. 3:3) to have been superseded by a more permanent building at Shiloh before David's time. In Roman Catholic churches the name is given to the receptacle in which the consecrated elements of the Eucharist are retained.

**TABERNACLES, FEAST OF**, name given in the Old Testament to a festival which marked the close of the harvest of fruit, oil, and wine in Palestine. As a harvest festival it is also known as the Feast of Ingathering (Ex. 23:16, 34:22) and can be traced back to the Canaanites. The festival was marked by general jubilation and by a visit to some sanctuary, accompanied by sacrifices for the purpose of testifying gratitude to the giver of fertility. Among the popular customs observed by the Canaanites was the erection of booths in the vineyards, in which the people dwelt during the vintage. Hence the name Festival of Booths (Tabernacles) in the four passages besides those already mentioned in which the ritual is set forth (Deut. 16:13-15, 31:10-13; Lev. 23:34-36, 39-41; Num. 29:12-40). This Canaanitish agricultural festival was adopted by the Hebrews and was given a historical aspect by interpreting the custom of dwelling in booths as a reminiscence of the nomadic stage in the life of the people and more particularly of the traditional forty years' sojourn in the wilderness when the tent formed the only habitation.

**TABES DORSALIS**. See SYPHILIS.

**TABLATURE**, a method of musical notation employed in the 15th and 16th centuries



TABLES Top Left, Switzerland 15th century, right, England, 18th century Middle Medieval gaming table from Japan Bottom Baroque table from France, about 1700.

chiefly for the lute. The lines of the stave indicated the strings on the instrument, the notes were expressed either by Arabic numerals or small letters, denoting the semitones of the chromatic scale, or the frets at which the fingers had to be placed to stop the strings. The duration of the sounds was ex-

pressed by such notations as minims, crotchets, and quavers placed above the stave, over the letter or letters which they were meant to affect.

**TABLE**, one of the few indispensable articles of domestic furniture, it was known to the Egyptians and Assyrians. The Greeks and

Romans used, low, plain tables of great variety in form and with costly decoration. In the Middle Ages tables came into universal use, and appear to have been portable. They were usually supported by trestles. The *drawing table* was introduced about the 16th century, and the *extended dining table* soon followed it. The *flap table* came into use in the second half of the 17th century. Tables are now of innumerable styles, sizes, shapes, and materials. Wood, however, generally predominates.

**TABLEAUX VIVANTS** ("living pictures"), representations of works of painting and sculpture, or of scenes from history or fiction, by living persons. They are said to have been invented by Madame de Genlis, when she had charge of the education of the children of the Duke of Orleans.

**TABLE BAY**, an inlet in the s.w. coast of Cape of Good Hope. In the s. corner lies Cape Town, at the foot of Table Mt. The bay is an important haven for shipping.

**TABLELANDS**, extensive elevated regions with a plainlike or undulating surface. They may be bordered by steep declivities falling more or less suddenly from the level of the plateaus to the sea or the adjacent low grounds; or they may slope down imperceptibly and thus gradually merge with the lowlands. Two types of tableland are recognized, plateaus of accumulation and plateaus of denudation. The former are built up of horizontal or approximately horizontal strata, while the latter are composed of disturbed strata which have been planed down to one general level.

**TABLE MOUNTAIN**, a mountain 3550 feet high overlooking Cape Town and Table Bay in the province of the Cape of Good Hope, S. Africa. It is often covered by a white mist called the *tablecloth*. See CAPE TOWN.

**TABLES, LUNAR**, tabular lists of numerical data based on the elements of the moon's orbit and used for calculating the moon's position in the sky.

**TABLE TENNIS** or **PING-PONG**, a game played upon a table, usually by two contestants, with a small, celluloid ball and small rackets or bats. The table is 9 ft. long by 5 ft. wide, and its upper surface must be 30 in. above the floor. The surface of a standard table is made of 5-ply wood, the resiliency of which is such that a standard ping-pong ball, when dropped from a height of one foot, will rebound to a height of from 8 to 9 in. Across the center of the table and projecting 6 in.

on either side is fixed a net 6 in. high. The ball is hollow, and from  $4\frac{1}{2}$  to  $4\frac{3}{4}$  in. in circumference. The rackets are oval in shape, and made of wood; to enable a player to have better control of the ball, both sides of the racket are frequently faced with sandpaper or stippled rubber.

The essential feature of the game is the striking of the ball back and forth over the net by the players until one misses the ball, or hits it into the net or off the table; in each of these cases his opponent scores a point. Except on the serve (see below) the ball may be struck only after it has bounced once on the table. A game is won by the player first scoring 21 points; however, if the score is tied at 20 points or is 21 to 20, the game is continued until one player has won 2 points more than the other. The game is begun by one player serving the ball to the other; the server strikes the ball so that it bounces first in his court, i.e., the part of the table between him and the net, and then goes over the net into his opponent's court. The server is permitted one attempt to get the ball into the other court in the manner described above; if he fails, his opponent scores a point. The server who opens the game serves until a total of 5 points have been scored and then his opponent serves for the next 5 points. After a tie at 20 points service alternates to the end of the game.

Exactly where and when ping-pong originated is not definitely known; some authorities believe it was invented about 1881 by English army officers in India, and others believe it originated in New England in the last decade of the 19th century. Beginning with the 1890's various forms of the game were played in England, a number of other European nations, and the United States. The game was played with balls made of cork or rubber until the beginning of the 20th century, when the celluloid ball came into use. Ping-pong was extremely popular in the countries mentioned above during the early years of the 20th century; interest in it dwindled after that time and was not revived until after World War I. The present great interest in the game began in Europe about 1921 and in the United States about 1927. The name "table tennis" was introduced about 1923 by manufacturers of equipment for the game who could not market their goods as "ping-pong" supplies because ping-pong was a registered trade name belonging to one particular manufacturer. The game is internationally regulated by the International



Table Tennis Association, which has as affiliates more than thirty national associations; one of them is the United States Table Tennis Association, which controls the game in the U.S. Sectional tournaments are held annually in the United States, and the winners meet in an annual national tournament consisting of matches in men's singles, men's doubles, women's singles, women's doubles, and mixed doubles. International tournaments, at which world's championships are contested, are also held annually.

**TABLE TIPPING**, or **TABLE TURNING**, the act of causing a table to tip, turn, or move, or movements made by tables, apparently without the application of physical force; the latter is believed by some to be due to the agency of departed spirits, or mysterious or occult influence, but by others to involuntary muscular action.

**TABLEWARE, SILVERPLATED**, an imitation of solid silver plate produced by using a body of cheaper metal. The earliest form was Sheffield plate, named from the English city where the process was developed. Birmingham also became an important center of the industry. In 1742 Thomas Bolsover of Sheffield, while repairing a knife, accidentally overheated it, so that the silver melted and spread in a thin coating over the copper. The fact that this coating stuck fast when cooled impressed him, and thus was invented a method of coating small copper objects with silver by the application of heat. Later Joseph Hancock improved the process so that large objects could be produced. Starting with a bar of copper or copper alloy between thin bars of silver, he heated them to fusion and then rolled them and rerolled them into a large flat sheet of silver-plated copper that could easily be shaped into all kinds of tableware, which were still further embellished by soldering on handles, knobs, and other ornaments of cast or stamped silver. If a cut edge of this plate was exposed, the copper showed, but in 1784 George Cadman overcame this defect by soldering on an ornamental molding of solid silver. The electroplated imitations of Sheffield plate do not have such a molding. Genuine old pieces of Sheffield plate are much prized for the warmth of color and the excellence of the texture, which are far superior to those of electroplated objects. (See **ELECTROPLATING**.) Worn pieces of Sheffield plate are often repaired by electroplating, but when so repaired are valueless from the standpoint of museum or collector. In 1840 John Wright, a surgeon of Birming-

ham, discovered the electroplating value of a solution of cyanide of silver in cyanide of potassium, and the new and cheaper process soon crowded out the old one. Wright's patent was purchased by the Elkingtons of Birmingham, who the next year erected large factories and inaugurated the development of the immense electroplating industry.

**TABOO**, a Polynesian term that now generally means an object or act religiously interdicted, and the religious system based upon such interdiction. Under various names the practice of taboo is found all over the earth, but it has nowhere else been so systematized as in Polynesia, where it primarily denoted something forbidden because the tabooed object was regarded as potent to injure, owing to its *mana* or mysterious (spiritual) power, which might be either holy, as a priest's possession, or unclean, as a corpse.

The idea of a thing being sacred involves a prohibition. And restrictions enforced by supernatural penalties become rules of conduct. Among the Maoris and Polynesians such prohibitions were included within the signification of the word "taboo", embracing both traditional rules binding on chiefs and people alike, and special prohibitions imposed like the interdict of a modern court of justice, from time to time. Some things, as idols, the persons and property of chiefs or priests, were always taboo, as well as some kinds of food, like the pork denied to women in Hawaii, and the water that might not be brought within the house in the Marquesas Islands. Many things were naturally taboo—women after childbirth, menstruation, the bodies of the dead, the head and hair of a chief, and the like—usages which touch the ceremonial uncleanness of Leviticus and some of the distinctive characteristics of Nazarites.

Taboo has been explained either as a priestly trick, or as a religious observance, but in many cases neither explanation suffices. There are taboos which are not religious at all. Some explain taboo as due to a categorical imperative and deduce from it all moral laws as well as most of the practices of civilized communities, such as caste, the wearing of ornaments, the carrying of umbrellas and the washing of newborn babes. On the other hand oaths, the punishment of murderers and thieves, and marriage restrictions may be developed out of a taboo system, which recognizes no moral sin, only the danger of breaking taboo. But in that case we have to do not with a categorical imperative, but with a belief in a mysterious



Frank Gillew

*Plaster seller pulverizing the raw material on a street in Tabriz, Iran*

spiritual potency and the fear of its effect. An extension of this belief results in its becoming purely formal.

**TABOR**, a small drum like a timbrel or tambourine without jingles usually played with one stick, in combination with a fife.

**TABRIZ**, capital of the province of Azerbaïjan, Iran, 40 miles E of Lake Urmiah on the Aji River. The city is the site of the interesting ruin, Kabud Masjid or "blue mosque" (dating from 1450) in part covered with blue tiles beautifully arabesqued. Owing to earthquakes there are many other ruins.

Tabriz exports carpets, dried fruits, hides and raw cotton, for the most part the imports are manufactured cottons and woollens, tea, and sugar. In the vicinity of the city are lead mines, and copper and cobalt are also found. During World War I the city was occupied by the Turks, January 13, 1915, but was captured by the Russians at the end of the month and remained in their hands until 1917. The Turks reoccupied the city in June, 1918, and retained it until the armistice was signed four months later. Pop. (1949) 272,000.

**TABU**. See TABOO.

**TABULA BANTINA**, a bronze tablet dating from between 118 and 90 B.C., now in the Naples Museum, Italy. It contains on one side an Oscan inscription referring to the town of Bantina in the ancient district of Lucania in S. Italy, and on the other side a portion of a law written in Latin. The tablet was found near Bantina in 1795 and has one of the few known inscriptions written in the Oscan language (see ITALIC LANGUAGES).

**TABULÆ EUGUBINÆ** or **IGUVINÆ**. See EUGUBINE TABLES, ITALIC LANGUAGES.

**TABULA ILIACA**, a small tablet in soft marble found at the site of the ancient town of Boville near Albino, Italy, in 1685 and now in the Capitoline Museum at Rome. The slab 10 by 11 inches is covered with scenes in low relief from the Trojan War taken from the *Iliad* of Homer and the poems of the Trojan cycle (see CYCLIC POETS) with explanatory Greek inscriptions. Some scholars believe that the relief was intended for school instruction, others that it was an ornamental panel of a bookcase.

**TABULARIUM**, a large building on the slope of the Capitoline Hill in Rome facing the Forum and adjacent to the *arx* or *ararium*.

(q.v.) or treasury (see SATURN, TEMPLE OF). It was built by Quintus Lutatius Catulus in 78 B.C. for the preservation of state records and consisted of a fivefold series of vaults. The colonnade opening toward the Forum was used in the Middle Ages as a salt magazine. The structure is in a good state of preservation.

**TABULATA**, a suborder of fossil corals characterized by the development of distinct horizontal septa or tabulae across the visceral chambers of the corallites. It includes such genera as *Favosites*, *Pluriodictyum*, *Muchulinia*, and others which are important members of the Paleozoic faunas.

**TACAHOUT**, native name of the small gall formed on the tamarisk tree, and which contains a large proportion of gallic acid.

**TACAMAHAC** (Sp. from Amer. Ind. *tacamahaca*, "stinking pot tree"), name applied to several varieties of aromatic oleoresins. One form of tacamahac is yielded by the balsam poplar, *Populus balsamifera*, found growing in the United States. Another variety is obtained from certain tropical American trees of the genus *Laphium*, which includes *L. tomentosum* and *L. tacamahaca*. East Indian tacamahac is obtained in several forms from trees of the genus *Calophyllum* (q.v.). The form known as yellow tacamahac is derived as an exudate from *C. inophyllum*, and *C. tacamahaca* yields the variety called Bourbon tacamahac. The many types of the resin are used extensively in the manufacture of varnish, and are useful in medicine as an ingredient of ointments and plasters.

**TACANA**, group of tribes, constituting a distinct linguistic stock, inhabiting the banks of the Upper Beni and Mamore rivers, north-eastern Bolivia. They are remarkable for their light complexion and fine features.

**TACCACEAE**, a family of monocotyledonous plants having large tuberous roots, large radical petioled leaves, and greenish flowers in a dense umbel at the top of a leafless scape. *Tacca* is a typical genus which furnishes starch and arrowroot.

**TACHÉ, ALEXANDER ANTOINE** (1823-94), Canadian Catholic archbishop, born in Rivière du Loup, Quebec, and educated at Quebec and Montreal. Becoming a monk of the Oblate order, he volunteered for service in the Red River district, and was the pioneer missionary in that region (1846). He became coadjutor bishop of St. Boniface (1850), bishop (1853), and archbishop (1871). He

labored to attain his ideal of a French-Canadian North-West, founding colleges, chapels, schools, and convents. He wrote *Twenty Years of Missions in the North-West*.

**TACHÉ, SIR ÉTIENNE PASCAL** (1795-1865), Canadian statesman, born in St. Thomas, Quebec. He studied medicine and practiced his profession until 1841, when he was elected to the Can. Legislative Assembly. He was successively commissioner of public works, deputy adjutant general of militia, member of the Legislative Council, and receiver-general. He became premier in the Taché-Macdonald ministry in 1856, but retired in 1857. In 1858 he was knighted. In 1864 he formed the second Taché-Macdonald ministry, combining the offices of premier and receiver-general.

**TACHINE FLY**, a parasitic fly of the family Tachinidae, resembling in general the common house fly. Tachine flies usually frequent vegetable gardens in search of hosts and destroy many injurious insects, especially caterpillars.

**TACHOMETER**, a contrivance for measuring velocity. There are several kinds of tachometer, as (1) a device to show the swiftness of a current by its effect upon a submerged paddle or paddle wheel; (2) an instrument for ascertaining the velocity of the blood in circulation; (3) a device for showing changes in the velocity of machines by the action of mercury in a revolving cup, which spreads from centrifugal force and causes the mercury to fall in a tube connecting with the cup; and (4) an instrument for giving directly the angular speed of a revolving shaft in revolutions per minute. This instrument is similar in principle to a small Watt governor with its spindle horizontal, the spindle being driven by the shaft whose speed is to be measured. The tendency of the revolving weights to fly outward is resisted by a spring, the compression of which is indicated by a needle moving round a dial, graduated to read revolutions per minute. Where, however, the exact speed is required, some form of speed counter should be employed, in which the revolutions are counted by the revolutions of a train of wheels. The tachometer, or speedometer, used on motor vehicles, is driven by one of the front wheels through gearing and a flexible connection.

**TACHYLYTE** or **TACHYLITE**, in petrology, a black, opaque, natural glass, formerly regarded as a mineral, which results from the rapid cooling of molten basalt. It is

found principally as a thin selvage to dikes or sills of dolomite or basalt, the latter having been cooled rapidly by contact with the adjacent rocks

**TACITUS, CORNELIUS** (55?-after 117 A.D.), Roman historian, born probably in Rome. The exact time and place of his birth are unknown, and even his praenomen is uncertain, one ancient writer giving it as Gaius and another as Publius. Tacitus was quaestor in 79 A.D., praetor in 88 A.D., and consul in 97 A.D. It is likely that he was employed in the provincial government of either Germany or Belgic Gaul between 90 and 93 A.D., and he is known to have been proconsul of Asia probably from 112 to about 116 A.D. The last twenty years of his life, following his consulship in 97 A.D., were devoted chiefly to the composition of the historical works of which less than half are extant.

The earliest work of Tacitus is the *Dia-logus de Oratoribus*, valuable for its description of Roman education, and published probably between 75 and 80 A.D. In 98 A.D. appeared the *De Vita et Moribus Iulii Agricolae*, an account of the life of his father-in-law, Gnaeus Julius Agricola (q.v.) and an excellent example of artistic biographical composition. The third of the minor works, all of which have been preserved, is the *Germania* or *De Origine, Situ, Moribus ac Populis Germanorum* (98 A.D.), a monograph on the ethnography of Germany.

The *Historia*, the first of Tacitus' two great works, was apparently completed about 116 A.D., just before the end of Trajan's reign; it is a history of the Roman Empire from 69 A.D. to the assassination of the emperor Domitian in 96 A.D. Of the original work, probably in fourteen books, only the first four and a part of the fifth are extant. His last and most characteristic work, commonly called *Annales* but more correctly titled *Ab Excessu Domi Augusti Libri*, is a history of the Julian emperors from Tiberius to Nero, covering the years 14 to 68 A.D. Originally there were sixteen books but only about half have been preserved, and these do not provide a continuous narrative. Parts of the fifth and sixth books, all of books VII, X, the beginning of XI, and the conclusion of XVI are lost, thus the account of the entire reign of Caligula, the first six years of that of Claudius, and the last three of that of Nero, are missing. Both the *Histories* and the *Annals* were lost in the Middle Ages and the extant sections are known only from two manuscripts, one discovered about 1430,

containing *Histories* I-V and *Annals* XI-XVI, and another, found about eighty years later, containing *Annals* I-VI.

The great power of Tacitus as a historian is due to his psychological insight and character portrayal. He studied men rather than events, and was concerned with an ethical point of view. A pessimist in his outlook upon Roman society, he often imputed base or unworthy motives to the men whom he described, particularly in his treatment of the emperor Tiberius, although his factual accuracy is above reproach. As a stylist, Tacitus is also deservedly famous; the three distinguishing features of his style are conciseness, variety, and poetic coloring. He was influenced by his study of the earlier historians Thucydides and Sallust (q.q.v.) and the ultimate development of his style, with its rich coloring and effective antithesis, is best seen in the *Annals*.

**TACITUS, MARCUS CLAUDIUS** (about 200-76 A.D.), Roman emperor in 275-76 A.D., born in Interamna (modern Terni), Umbria. He was consul in 253 A.D. and was elected emperor two years later by the Roman senate after an interregnum of six months following the death of the emperor Aurelian. During his reign of only two hundred days he instituted domestic reforms and tried to have favored the restoration of power to the senate. He is thought to have been murdered by his soldiers in Asia.

**TACK,** a nautical term signifying to change the course of a sailing vessel so as to bring the wind round by the head to the other side of the vessel; it is opposed to *beat*. As a noun it has many meanings, including (1) a rope or purchase for hauling down and fastening the corners of a tent or sails; (2) the corner of a sail to which such a rope is fastened; (3) the direction in which a vessel sails, considered in relation to the position of her sails; and (4) the distance run at one time in such direction.

**TACKLE,** a combination of blocks and ropes designed to increase the capacity of the available power to move heavy weights or decrease the time required to move an object with a power capable of moving only at a certain speed. The block consists of a shell or frame containing one or more sheaves or pulleys and a strap to attach the block to the weight or support. It is evident that in all cases one block of a tackle, or one end of the rope—if there is a single movable block—must be fixed. This being the case, in simple

purchases and neglecting friction we have,  $P = \frac{W}{N}$ , in which  $P$  is the power,  $W$  the weight, and  $N$  the number of parts of rope at the movable block. The amount of power lost by friction depends upon many things, such as the character of the rope, its size with reference to the diameter of the pulley and the weight to be raised, the condition of the atmosphere, and the bearings of the pulleys. But in ordinary tackles, with the usual type of pulleys, rope, etc., the loss by friction is estimated at about one sixth the gain effected by each pulley or sheave.

**TACLOBAN**, capital of the province of Leyte, Philippine Islands, on San Juanico Strait, between Leyte and Samar. The town is well built and has an extensive export trade. There is a good harbor with four commodious wharves. Pop., about 14,000.

**TACNA**, southernmost department of Peru, bordering Chile on the south. Its level and arid interior is enclosed by the slopes of the Andes on the east and the coast range on the west. The rainfall is scanty and, excepting river valleys, the interior is an arid desert. The climate is unhealthy and earthquakes not infrequent. There are deposits of nitrate, silver, and copper, which are mined to a limited extent. The largest city is the capital, Tacna. The department formerly belonged to Peru but was ceded to Chile for ten years in 1883. In 1929 it was restored to Peru by treaty. Area, 49,80 sq. m.; pop. (1950 est.) 44,535. See **TACNA-ARICA DISPUTE**.

**TACNA**, capital of the department of Tacna, Peru, situated in the s.w. part of the department, about 40 m. by rail n. of Arica, Chile. It was formerly a place of considerable commercial importance with notable municipal and industrial establishments, but the construction of railway lines in the province of Antofagasta, Chile, diverted the trade southward. Pop., about 18,000.

**TACNA-ARICA DISPUTE**, the long-standing dispute between Peru and Chile in regard to the ownership of the provinces of Tacna and Arica. This international controversy was argued intermittently following the conclusion of the Chilean-Peruvian War and the Treaty of Ancón (1883). By the treaty Chile was awarded the province of Tarapaca outright. The provinces of Tacna-Arica, on the other hand, were to remain in Chile's possession for ten years, upon the conclusion of which a plebiscite was to be held in the territory to decide its ultimate disposition. A

payment of 10,000,000 Peruvian soles (Chilean dollars) was to be made to the defeated contestant nation.

At the expiration of the ten-year period Peru demanded the execution of the treaty, but on the understanding that only Peruvian citizens be allowed to vote in the plebiscite; this made it impossible to come to any agreement in the matter, so the dispute continued and became a *cause célèbre* in both countries, political campaigns being waged on it as the single issue. Relations were broken off in 1901, resumed in 1905, severed again, resumed in 1910, and cut off indefinitely in 1911. In 1919, aroused by the anti-Peruvian riots in Chilean cities, and the publication of the Chilean-Bolivian Treaty of 1905, by which Bolivia had been promised an outlet to the sea by way of the city of Arica, Peru once more pressed her claims. In 1920 she asked that the question be put on the agenda of the Assembly of the League of Nations, only to withdraw the request soon after. It was not until 1922 that the first hope of a settlement appeared. On Jan. 17, 1922, the United States dispatched identical notes to Chile and Peru for the purpose of effecting an agreement. On July 15, a protocol was signed by representatives of both nations nominating the President of the United States as arbiter. Chile and Peru accepted the protocol as the basis for discussion, and in February, 1923, delegates arrived in Washington, and the long process of investigation and filing of briefs and counterbriefs was begun. In 1925 President Coolidge decided that a plebiscite should be held under the auspices of a Plebiscitary Commission of three members, one appointed by the United States, and one each by Chile and Peru. Both countries accepted this decision and the Commission commenced preparing the ground for a plebiscite. In March, 1926, the plebiscite was indefinitely suspended due to continued disorders and riots in the provinces, and on June 14 the Commission by a two to one count voted to abandon the plebiscite altogether, whereupon the Chilean ambassador in Washington notified Secretary of State Kellogg that the unexpected outcome of the efforts for a plebiscite automatically ended the arrangement whereby the good offices of the United States had been invoked. A two-year period of deadlock ensued during which no negotiations were carried on.

At the Pan-American Conference in Havana, February, 1928, the delegates of Chile and Peru met and agreed to urge the resump-

tion of diplomatic relations between their governments. On July 9, Secretary Kellogg sent notes to both governments urging the same thing. On July 13, diplomatic relations actually were resumed, and in October the respective embassies were re-established after a lapse of seventeen years. In the meantime, a Boundary Commission had been holding sessions in New York for three years. At the request of the State Department this Commission suspended activities so as to leave the field free for diplomatic negotiations. Through such negotiations a tentative agreement was reached in 1929, which was submitted to President Hoover who, in turn, transmitted it to the intending governments, as basis for a final solution. In May, 1929, both Chile and Peru accepted the proposals, which were incorporated into a final treaty on June 3, ratified by both parties amid great rejoicing. By this treaty Tacna was given to Peru, and Arica to Chile, who agreed to pay Peru the sum of \$6,000,000.

**TACOMA**, port of entry and county seat of Pierce Co., Wash., situated on Commencement Bay, an arm of Puget Sound, about 35 miles s. of Seattle. It is served by four transcontinental railroads, and by numerous steamship lines, operating to ports on the Atlantic and Pacific coasts and all over the world. Tacoma is the third-largest city in population in the State, one of the chief seaports on the Pacific Coast, and one of the principal lumber-manufacturing and shipbuilding centers in the U.S. Facilities of Tacoma's natural deep-water harbor include five waterways, about 35 docks and wharves, coal bunkers, municipally owned piers covering an area of about 280 acres, and the ocean docks, terminals, and shops of two of the transcontinental railroads which serve the city. In a recent year, the total volume of cargo handled by the port of Tacoma amounted to more than 6,800,000 tons. Among the industrial establishments in the city, in addition to the extensive railroad repair and construction shops, lumber mills, and shipbuilding yards, are electrochemical plants, paper and pulp plants, printing and publishing plants, flour and cereal mills, fruit and vegetable canneries, plants processing dairy products, quick-freeze plants for vegetables and berries, and factories manufacturing plywood, wood veneers, sash and doors, furniture, bread and bakery products, bottled pickles, jellies and fruit juices, dried fruits, and iron and steel. Tacoma also contains one of the largest ore smelters in the U.S. re-

fining about 10% of all the copper in the U.S., as well as gold, silver, and white arsenic. The rich agricultural region surrounding the city is noted for the cultivation of berries, fruits, vegetables, dairy products, poultry, and horticultural specialties, notably daffodil bulbs.

The city rises from the bay to a plateau about 400 ft. above sea level, with the Olympic Mountains on the w. horizon and Mount Rainier (14,408 ft. above sea level) towering 56 miles to the s.e. A forested area, with many picturesque fresh-water lakes, surrounds the city. On the s. outskirts of Tacoma are Fort Lewis and McChord Field. The former, one of the largest permanent army posts in the U.S., covers an area of 110,000 acres and includes an air field and a large general hospital; McChord field is a large U.S. Air Force Base. Educational and cultural facilities in the city and vicinity include the College of Puget Sound (Methodist), established in 1888; Pacific Lutheran College; and the Ferry Museum, containing a collection of Indian relics and artifacts. The municipal park system covers more than 1100 acres, including rose gardens, a zoo, a deep sea aquarium, and facilities for fishing, boating, and other recreations. An outdoor stadium in the heart of the city has a seating capacity of 40,000 persons. Mount Rainier National Park (qv) may be reached from Tacoma in two hours.

The site of the present city was first visited by the English explorer Capt. George Vancouver in 1792. Although several temporary settlements were established in the region in the first part of the 19th century, permanent settlement did not take place until 1868, when Gen. Morton Matthew McCarver founded a lumbering settlement on the site. The Northern Pacific Railroad reached the settlement of Tacoma in 1873 and established a terminus called New Tacoma, which became the county seat in 1880. In 1883 Tacoma and New Tacoma were consolidated and incorporated as a city. Pop. (1950) 143,673.

**TACÓN**, MIGUEL DE, MARQUÉS DE LA UNIÓN DE CUBA (1777-1855), Spanish military officer and civil administrator. In 1806 he served as the Spanish military governor of the city of Popayán, Colombia; from 1809 to 1814 he led royalist troops against the revolting colonies of Spanish America. Tacón is noted chiefly for his administration of the Spanish colony of Cuba (see *CUBA: History*), of which he was captain general or governor

from 1834 to 1838. Although he was responsible for a number of new public works and improved police service in Havana, his rule of Cuba was arbitrary and oppressive. In 1836 he forcibly repressed the Cuban movement, centering in Santiago, to obtain for Cuba political rights which had been granted by the Spanish constitution of 1834; and in 1837 he refused permission for the Cuban deputies elected to the Spanish Cortes, or national legislature, to participate in the deliberations of that body.

**TACONIC MOUNTAINS**, a range lying on the borders of New York and Massachusetts, and extending into the s.w. corner of Vermont, making a connection with the Green Mountains. The highest peak is Mt. Equinox in Vermont, 3816 ft.

**TACUAREMBO**, department in n. Uruguay, bounded on the s by the Rio Negro. The chief occupation of the people is stock raising. The capital is Tacuarembó Area, 8112 sq m; pop. (1947) 108,346.

**TACUBAYA**, a Mexican town in the Federal District, 3 mi. n. of Mexico City. Pop., about 55,000.

**TACULLI**, or **TAKULLI**, an Indian tribe of Athapascan stock, inhabiting the headwaters of the Peace and Fraser rivers in Central British Columbia. These Indians knew the art of spinning yarn from the mountain goat's hair; they are now Christianized and living on reservations. The number is about 750.

**TADPOLE**, a young amphibian, as a frog or toad, breathing by external gills and having a tail with extended membrane giving it a fishlike form. See **FROG**.

**TADZHIKSTAN**. See **TADJIK SOVIET SOCIALIST REPUBLIC**.

**TAEI**, a Portuguese Malay-Hindu name for the Chinese *liang*, a money of account varying in different parts of the empire. The *haikwan* (or customs) *tael*, a tael weight of silver, varies in value according to the fluctuations of the bullion, sometimes falling as low as 60 cents, at other times reaching as high as 80 cents.

**TAENIOPTERIS**, a genus of fossil ferns found in rocks of late Paleozoic and Triassic age. They have long, leathery fronds of linguulate form with entire margins, a strong central rib, and numerous closely parallel veins that run at right angles from the midrib to the margins.

**TAENSA**, or **TENSA**, a historic American Indian tribe that flourished about 1700, in seven villages between the Tensas River and

the Mississippi, in the present Tensas Parish of Louisiana, about 20 m. from Natchez. Like the Natchez stock they were sun worshippers and kept a sacred fire constantly burning in a temple. They were probably merged finally into the Choctaw or the Creek Confederacy. Nothing is known positively of their language.

**TAFFETA**, a term formerly applied to all plain silks simply woven by regular alternations of the warp and filling, and, by some writers, supposed to be the first kind of silk weaving known even to the Chinese, from whom it came to us. Modifications have been introduced, by varying the quality of the warp and filling, and by the substitution of various colors for the single one of the original taffeta, and therefore it has become a sort of generic term for plain silk, or silk woven in lines so fine as to appear plain woven.

**TAFFRAIL**, the rail around the stern of a vessel; formerly the name was applied also to the place within the rail.

**TAFILET**, a large oasis in the n.w. part of the Sahara, belonging to Morocco. It is situated at the southern base of the Atlas Range, 200 miles s. of Fez. The chief product is dates. There are about 150 towns and villages in the oasis, the largest and most important commercial center being Abuam. Area, about 500 sq m; pop., about 120,000.

**TAFT**, a city of Kern Co., Calif., situated about 110 miles s.w. of Los Angeles. Transportation facilities include a railroad. The city lies in the s. San Joaquin Valley, a fertile agricultural area in which citrus and deciduous fruit, grapes, pears, apples, hay, cotton, and dairy products are grown. The region is also rich in oil and natural gas. Pop. (1950) 3707.

**TAFT**, a city of San Patricio Co., Tex., situated about 20 miles n. of Corpus Christi. Transportation facilities include a railroad. Taft is surrounded by an agricultural and oil producing area, and is an important market for cotton, grains, cattle, and oil. Among the industrial establishments in the city are a cotton compress and a cottonseed-oil mill. Taft is the site of the Presbyterian School for Mexican Girls. Pop. (1950) 2978.

**TAFT**, CHARLES PHILIPS (1843-1929), American newspaper owner and editor, half brother of Henry W. Taft and William H. Taft, born in Cincinnati, Ohio, and educated at Yale University and in Heidelberg, Berlin, and Paris. Admitted to the bar in 1866, he



*President William Howard Taft*

nacted law from 1869 to 1879, when he purchased the Cincinnati *Times*. This paper he consolidated with the *Star* in 1880 as the *Times-Star*, of which he was thereafter editor. He served as a member of the Ohio House of Representatives in 1871, and of the 54th Congress (1895-97). From 1898, to 1908 he was president of the Cincinnati Board of Sinking Fund Trustees. In 1908 he was a delegate to the Republican National Convention.

**TAFT, LORADO** (1860-1936), American sculptor, born in Elmwood, Ill., and educated at the University of Illinois. He studied art at the École des Beaux-Arts, Paris, under Dumont. He later settled in Chicago, becoming in 1886 an instructor at the Art Institute. His works include the Washington Monument, Seattle; a military group in Jackson, Mich.; and various fountains, such as the "Columbus Memorial Fountain". Taft was elected to the National Academy (1911) and the National Institute of Arts and Letters. He wrote a *History of American Sculpture*, said to be the best work on the subject.

**TAFT, ROBERT ALPHONSO** (1889-1953), American political leader and legislator, son of William Howard Taft (q.v.), born in Cincinnati, Ohio, and educated at Yale and Harvard universities. He began the practice of law in Cincinnati in 1913. He later became a

director of a number of business corporations in the city. During World War I he was an assistant counsel of the U.S. Food Administration in 1917-18, and in the following year he was a member of the American Relief Administration, which organized relief for the stricken survivors of the war in a number of European countries. Taft was a Republican member of the Ohio House of Representatives from 1921 to 1926 and was speaker of the House in the latter year; in 1931-32 he was a member of the Ohio State Senate. He was elected U.S. senator in 1938 and re-elected in 1944 and 1950. In the Senate he exercised considerable influence in the shaping of Republican policy on domestic issues; in 1947 he was the coauthor with Representative Fred Allan Hartley of New Jersey of the Taft-Hartley law amending the National Labor Relations Act (q.v.) of 1935. This law, among other provisions, prohibited the negotiation of closed-shop agreements (q.v.) between unions and employers. In 1948 and 1952 Taft was an unsuccessful candidate for the Republican Presidential nomination. He wrote *Foreign Policy for Americans* (1951).

**TAFT, WILLIAM HOWARD** (1857-1930), American jurist and statesman, twenty-seventh President of the United States, and chief justice of the U.S. Supreme Court, born in Cincinnati, Ohio, and educated at Yale College and at the Cincinnati Law School. He practiced law in Ohio for some years, and in 1887 became a judge of the Ohio Superior Court. Three years later President Benjamin Harrison appointed him U.S. solicitor general, and from 1892 to 1900 Taft was a judge of the U.S. Circuit Court. During this period he also served from 1896 to 1900 as professor and dean of the law department at the University of Cincinnati. In 1900 President William McKinley selected Taft to head the U.S. Philippine Commission, charged with the establishment of a civil government in the Philippines, which had recently come under U.S. sovereignty as a result of the Spanish-American War of 1898-99. Having completed this task, Taft was appointed the first civil governor of the Philippines in 1901. After three years of creditable service in the governorship Taft was named secretary of war in 1904 in the cabinet of President Theodore Roosevelt. He served in that capacity for four years. In August, 1906, a revolt against the U.S. authorities broke out in Cuba; Taft was despatched to the island in the following month, and served briefly as provisional governor, adjudicating certain



issues involved in the uprising and re-establishing U.S. military control (see *CUBA HISTORY*)

Roosevelt personally named Taft as his successor in the Presidency, making it possible for Taft to win the Republican nomination with little opposition. Taft easily defeated the Democratic candidate, William Jennings Bryan (qv), in the election of 1908 and, after assuming office, continued many of the policies initiated by Roosevelt. He vigorously prosecuted the campaign against the corporate trusts in the Federal courts, strengthened the provisions of the Interstate Commerce Act (qv) and actively furthered the policy of "dollar diplomacy" whereby friendly relations with foreign countries were fostered through the extension of governmental support to U.S. businessmen seeking to arrange investment abroad. Taft also favored the traditional protective tariff policy of the Republican Party (qv) but widespread protests against the prevailing high tariffs caused him to support the enactment of the "Duties on Tariff Act" of 1909 entailing moderate downward revision of certain customs duties (see *TARIFF*, UNITED STATES). The passage of this law resulted in a serious loss of popularity to the Taft administration which was accused by opponents of the president of having failed to carry out a pre-election promise to effect a drastic reduction in the tariff.

In 1910 Taft dismissed Gifford Pinchot (qv) head of the Division of Forestry because of the latter's criticism of the administration of public land by the secretary of the interior Richard Ballin (qv). This action incurred the disapproval of the actions of the public resulting in a further reduction in Taft's popular support. Dissatisfied with Taft's policies, Roosevelt publicly declared his opposition to Taft in 1911 and announced that he was a candidate for the Republican Presidential nomination. Taft won re-nomination, however, and Roosevelt thereupon withdrew from the Republican Party to form a new organization, the Progressive Party (qv). In the election of 1912 Roosevelt secured a higher popular and electoral vote than Taft, but the net result of their conflict was the election of the Democratic candidate Woodrow Wilson.

From 1913 to 1921 Taft was professor of law at the Yale Law School. He was one of the few leading Republicans who favored the entry of the United States into the League of Nations after World War I. In 1921 Presi-

dent Warren G. Harding appointed him, chief justice of the U.S. Supreme Court, in which he distinguished himself by his considered support of conservative principles of jurisprudence. Ill-health compelled him to retire from the Court early in 1930; he died soon afterward.

**TAFT-HARTLEY ACT.** See *NATIONAL LABOR RELATIONS ACT*

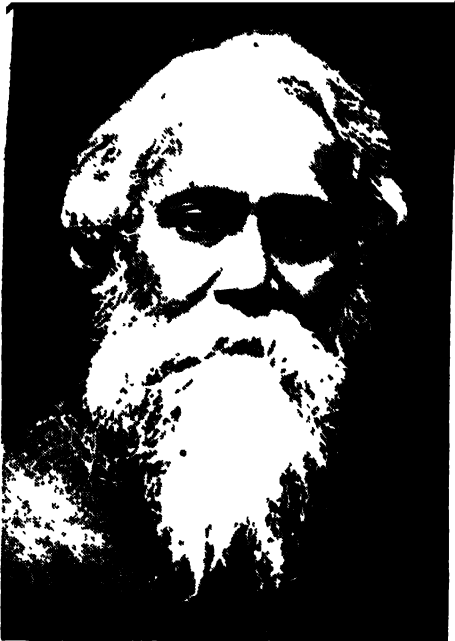
**TAGANROG**, a seaport in the Rostov Region of the Russian Soviet Federated Socialist Republic, situated on the N. shore of the Gulf of Taganrog, an arm of the Sea of Azov 18 miles N.W. of the mouth of the Don R. The bay surrounds Taganrog on three sides and the city has three harbors, which are icebound for three or four months each year. The city has paper and metallurgical factories, a fishing industry, and an important trade in nuts, fruits, coffee, tobacco, and oil. Its export are largely transhipped by water from Rostov on Don. Educational facilities in Taganrog include training schools for leather and railway workers. Taganrog was founded in the 13th century by merchants of Pisa, Italy. After being held for centuries by the Turks, it was annexed by Russia in 1791 and by 1850.

**TAGASASTI** or **TOGASASTI**, a shrub *Cyrtus plectellus* of the family Leguminaceae. It is native of the Maldives and the Canary Islands, where it is an important fodder plant in which it has been introduced into South Australia. It is well adapted to dry soil and climates but cannot be dependent upon where there is danger of frost.

**TAGBANUA**, a people including a large part of the island of Palawan and some of the adjacent islands of the Calamian group. They are broken up into several divisions, the members of which differ in looks and cultural conditions, to the amount of intercourse they have had with the pygmy tribes or coast Malay peoples. Those who have had extensive dealings with the latter have borrowed from them their type of dress and many articles used in daily life. The tribe has a syllabic alphabet with which they write their language. Smooth joints of bamboo are used as a substitute for paper, and on them the characters are scratched.

**TAGBILARAN**, capital of Bohol, Philippine Islands, at the southwest extremity opposite Panglao, the center of an agricultural district. Pop., about 10,000.

**TAGGART**, THOMAS (1856-1929), American politician, born in County Monaghan, Ire-



*Sir Rabindranath Tagore*

land, and brought to America by his parents in 1861, settling first in Xenia, Ohio. In 1872 he went to Indianapolis and later acquired a major interest in the resort hotel at French Lick Springs, Ind. A Democrat, in 1886 he became auditor of Marion Co., Ind., an office usually held by a Republican. This victory marked the beginning of his long leadership of the Democratic Party in Indiana. He was re-elected to the auditorship of Marion County in 1890, served as mayor of Indianapolis from 1895 to 1901, and was appointed to the U.S. Senate in 1916 to fill the vacancy caused by the death of Senator Shively. He was chairman of the Democratic State Committee of Indiana in 1892-94, district chairman of the 7th Congressional District for twelve years, and a member of the Democratic National Committee from Indiana from 1900 to 1916 (chairman in 1904-08).

**TAGLIAMENTO**, river in northeast Italy, rising in the Carnic Alps and flowing through the Udine Province into the Adriatic, 106 m. In World War I, after the Italian forces had been overwhelmed at Caporetto, Oct. 24, 1917, they retreated to the line of the Tagliamento and there sought to stem the Austrian advance. The Austrians forced the river crossing the following month and the Italians continued their retreat to the Piave,

the Austrians falling back in turn to the Tagliamento in November, 1918.

**TAGLIONI**, MARIA (1804-84), Italian dancer, born in Stockholm, Sweden, of Italian parents (her father being a ballet master). She created a furor by her debut in Paris in 1825, and afterward was first ballet dancer at the opera in Vienna, Paris, and Berlin.

**TAGORE**, SIR RABINDRANATH, or RAVINDRANATH THAKURA (1861-1941), Hindu poet, musical composer, and painter, born in Calcutta. Long popular in India, he gained an international reputation and was awarded the Nobel Prize in literature for 1913. At the age of seventeen he went to Europe to complete his education. On his return to India he first became known as an educator and philosopher, being the founder of a university in Bengal. Tagore spent some time in America in Urbana, Ill., and in New York. He was knighted by King George in 1915. His works include *Letters From Abroad* (1921). His poems are also published in *Fireflies*, English translations from the Hindi poems (1928).

**TAGUCHI**, RIKI HIRO (1890- ), Japanese educator and publicist. He was the foremost exponent of modern Japanese judo. See JUDO.

**TAGUS**, largest river of the Spanish Peninsula, which rises in Sierra Albarracin, Spain. It first flows northwest, then curves to the southwest, and flows mainly in that direction past Aranjuez, Toledo, and Alcantara, and in Portugal, Abrantes, Santarem, and Lisbon, entering the Atlantic about 10 m. lower down. Below Salvaterra it divides into two arms, the western Tejo Novo and the eastern Mar de Pedro, which flow into the Bay of Lisbon. Its total length is 566 m.

**TAHITI** (formerly *Otaheite*; Fr. *Taïti*), the largest and most important of the Society Islands (q.v.), a French possession in the S. Pacific Ocean. Tahiti is situated 2348 miles n.w. of Wellington, New Zealand, 4486 miles w.s.w. of Panama, and 3663 miles s.s.w. of San Francisco. The chief town on the island is Papeete (pop., about 12,400, including about 8000 French), which is also the capital of the Society Islands and of French Oceania. Tahiti is located in the Windward group, or the southeastern part of the Society Islands. It possesses a coastline of 120 m., and an area of 402 sq.m. The population is about 25,000.

The island consists of two unequal and nearly circular portions connected by a narrow isthmus called Taravo, about one mile wide and 50 ft. or less above sea level. The



Ewing Galloway

*Natives with an outrigger canoe on the shore of the island of Tahiti*

southern portion is called Itaiapu or Fāhiti (Little Tahiti) and is 11 m long and 6 m wide. The northern portion Poronuu (Great Tahiti) is 22 m long and 20 m wide. The entire island is of volcanic origin and mountainous. The remnants of old volcanoes rise in a succession of concentric terraces to the summits, the highest of which possesses an elevation of 1320 ft above sea level. The mountains have been eroded by numerous streams which have cut large valleys and deep gorges down the slopes. The climate is warm and equable, the temperature ranging from 60° to 90°F. Rainfall is abundant and the island is covered with a luxuriant vegetation. The central peaks are surrounded by a low strip of coastland consisting of volcanic detritus which mixed with coral sands from the surrounding reefs makes an extremely fertile soil. Agricultural products are bananas, coconuts, oranges, sugar cane and vanilla beans. The principal industries are the preparation of copra, sugar and rum. The gathering of pearls and mother of pearl is also important. The chief exports include copra, vanilla beans, mother of pearl, and phosphates. The native inhabitants are Polynesians (qv). Transportation on Tahiti is provided by a road which encircles the island. Educational facilities include a normal school,

a higher primary school and more than 80 primary schools which are attended by more than 5100 students. The island is governed as a part of French Oceania (see FRENCH ESTABLISHMENTS IN OCEANIA).

**History.** The Society Islands were probably first visited in 1606 by the Spanish navigator Pedro Fernández de Quiros. Although several explorers visited the group before Captain Cook (see COOK, JAMES), it is chiefly Cook who gave the world the first detailed description of Tahiti and the islands following his visit in 1769, 1771, 1774 and 1777. At the time of Cook's visits the Society Islands were under the rule of minor chiefs exercising both civil and religious authority. Partly as an outcome of the visits of Cook and other explorers to Papeete which placed firearms in the hands of the chief of that district, that particular local ruler acquired the sovereignty over the entire archipelago and laid the foundation of the royal house of Pomare (qv). In 1788 Tahiti was visited by the ship *Countess* (qv) and soon after became the place of refuge for the mutineers of that English vessel. France established a protectorate over Tahiti in 1843, and the island became a part of French Oceania in 1903. During World War I Papeete was bombarded in 1914 by two German warships. In 1940,

during World War II, Tahiti joined the Free French movement of General Charles de Gaulle.

**TAHLEQUAH**, county seat of Cherokee Co., Okla., situated 35 miles N.E. of Muskogee. Transportation facilities include a railroad and a municipal airport. The city is the trading center of an agricultural area in which corn, cotton, oats, and strawberries are the chief crops. The principal industries in the city are canning, cotton ginning, and the manufacture of machine-shop products. Tahlequah is the site of Northeastern State College, a teachers college established in 1846. The city lies between two lakes formed by dams on the Grand and Illinois rivers. In the vicinity is the Sequoyah Indian Training School. On the site of the present city was at one time located the capital of the Cherokee Nation. Pop. (1950) 4750.

**TAHOE LAKE**, a lake situated on the boundaries of Placer and Eldorado counties, Calif., and Ormsby and Douglas counties, Nev. It is situated in the Sierra Nevada in the midst of scenery of great beauty and grandeur, at an altitude of about 6225 ft., and is 22 m. long by 10 m. wide.

**TAHPANHES** (Heb *Takhpankhēs*) or **TEHAPHNEHES** (Heb *Tekhaphnekhēs*), a city of northeastern Egypt mentioned in the Bible. It is probably to be identified with the town called by the Greeks Daphnæ, which was situated in the Nile delta about 25 miles S.W. of Pelusium. Daphnæ was a military post of some importance in the time of Psammetichus I, who fortified it and established in it a garrison of Greek mercenaries. The site, occupied by the modern Tel Defenneh, was explored by Sir Flinders Petrie in 1886.

**TAI-CHUNG**, formerly TAICHU, city of Formosa, China, situated near the coast in the western central portion of the island. It is served by a railway. Pop. (1950) 207,009.

**TAIGNANFU**, departmental city of the province of Shantung, China, situated at the foot of the famous Mount Tai, or Tai Shan, 60 miles S.S.E. of Tsinanfu, the capital of the province. The importance of Tainanfu is due chiefly to the immense numbers of pilgrims who come to visit Mount Tai. Its suburbs on the south and west, however, are large, populous, and prosperous. The most important of the numerous temples of Tainanfu is the Tai Temple, covering several acres, surrounded by a strong wall and containing many fine old cypresses. Pop., with suburbs, about 80,000.

**TAILFER, PATRICK**, American colonist, remembered for the polemic entitled *A True and Historical Narrative of the Colony of Georgia in America from the First Settlement thereof until the Present Period* (1741). Tailfer, a physician who had emigrated to Georgia, disapproved of the administration of the Colony. In 1740 he went to Charleston, S.C., where, with the assistance of Hugh Anderson and David Douglass, he published the work mentioned above. In this work he mercilessly attacked Governor James Edward Oglethorpe.

**TAILHADE, LAURENT** (1854-1919), French poet, born in Tarbes, and educated at the lycée of Pau. His first writing, which shows Parnassian influence, was well received by De Banville. Tailhade is noted for ballads and satirical verse. His last work includes *Un Monde Qui Finit* (1909), *La Forêt* (1910), and *Pages Choiesies* (1912).

**TAILLANDIER, SAINT-RENÉ**, properly RENÉ GASPARD ERNEST (1817-79), French writer, born in Paris. In 1863 he succeeded St-Marc Girardin at the Sorbonne. He was admitted to the Academy in 1873. His chief work was to bring the literature of Germany to his countrymen in such books as *Histoire de la Jeune Allemagne* (1849). He also translated the Goethe-Schiller letters (1863).

**TAILLE**, in France, before the Revolution of 1789, a tax or imposition levied by the monarch or a lord on his subjects. It was a kind of income tax levied upon the lands and houses of the unprivileged classes, and from which the privileged classes were immune.

**TAILLON, SIR LOUIS OLIVIER** (1840-1923), Canadian statesman, born in Terrebonne, province of Quebec. He was elected a Conservative member of the provincial legislature in 1875 and sat therein until 1896. He was speaker of the legislative assembly (1882-83), attorney general (1884-86), premier (1887; 1893-96), and leader of the Opposition (1887-90). In 1896 he was appointed postmaster general in the dominion cabinet of Sir Charles Tupper, but resigned on the latter's defeat the same year. In 1900 he was an unsuccessful candidate for the House of Commons. He was knighted in 1916.

**TAILOR BIRD** (*Orthotomus sutorius* or *Sutoria sutoria*), bird belonging to the family Sylviidae. The male is olive green; wings brown, edged with green; the two central tail feathers are long. The name "tailor bird" is derived from the way in which the nest is formed. Two or three leaves are stitched to-

gether by means of silk from cocoons, thread, wool, or vegetable fibers, the necessary holes being made by the bill. In the cup thus formed the nest is made.

**TAIN**, ancient royal burgh of Ross-shire, Scotland, near the south shore of the Dornoch Firth, 44 m from Inverness. Pop. (1951 prelim.) 2350.

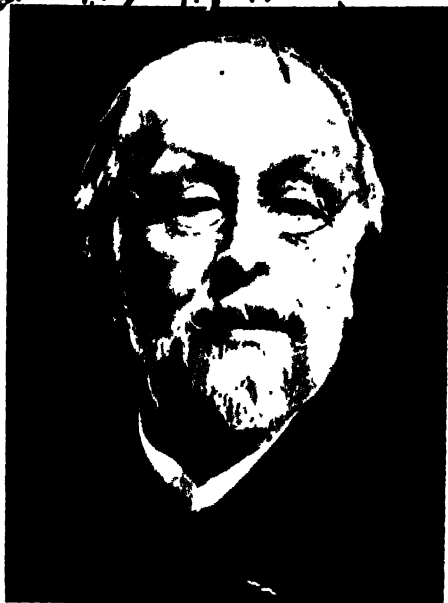
**TAINAN**, a city of the Chinese island of Formosa (Taiwan), situated in the s.w. portion of the island, 3 miles e. of Ampin, its port. Tainan was once the capital of Formosa (q.v.) Pop. (1950) 229,452.

**TAINE**, HIPPOLYTE ADOLPHE (HENRI TAINI) (1828-93), French critic, born in Vouziers, Ardennes. First employed in the state educational service, he later returned to Paris. In 1854 Taine won the Academy's prize for an essay on Livy. In 1864 he became professor of esthetics and the history of art at the École des Beaux-Arts in Paris. He was elected to Loménie's chair in the French Academy in 1878. Some of his maturest critical work is to be found in the *Essais de Critique et d'Histoire* (1857) and the *Nouveaux Essais* (1865), and his most vigorous polemic in *Les Philosophes Français du XIX<sup>e</sup> Siècle* (1856), an attack on Cousin and Jouffroy. Perhaps Taine's greatest work, however, is his study of the Revolution, its causes and its issues, *Les Origines de la France Contemporaine* (1875-90), published in separate parts.

**TAINTER**, CHARLES SUMNER (1854-1940), American inventor born in Watertown, Mass. In 1874 he was a member of the United States Transit of Venus Expedition to the Southern Pacific. He became known chiefly for his invention of a graphophone, but was also associate inventor of the radiophone, an instrument for transmission of sounds by the agency of light.

**TAIPEH**, formerly, TAIPOKI, administrative center of Formosa, China, situated in the n. part of the island, about 15 m inland from Keelung. Taipeh is linked by railway with Keelung, its port, and with all other important communities in Formosa. Among the chief points of interest in the city, which is one of the most modern in China, are a Buddhist shrine and botanical gardens. The leading manufactures are refined camphor and tobacco products. Pop. (1950) 450,777.

**TAIPIING REBELLION**, a popular revolution against the imperial government of China, extending from 1848 to 1864 and so named because its leaders sought to replace the Manchu dynasty of Chinese emperors



*Hippolyte Taine (painting by Léon Bonnat)*

with a *Tai-ping* (Chin., "great peace") dynasty. In its formative stages, the rebellion assumed the aspect of a religious movement, which was initiated in the 1840's by Hung Hsiu-ch'uan (q.v.), a fanatical mystic. The movement, based in part on Christian doctrine and aimed at idolatry, gained numerous followers, particularly in s. China. With the organization of these followers into associations, Hung and his lieutenants began seriously to challenge imperial authority.

The first stage (1850-59) of the rebellion was marked by sporadic local outbreaks. In 1850 the insurgents embarked on a general offensive against the national government. A sequence of victories in the s. was followed by an invasion of n. China. Nanking, which fell to the rebels in 1853, became Hung's headquarters. During the next seven years his forces imposed repeated defeats on the imperial armies. Largely because of administrative weaknesses and a lack of military discipline, the rebels were unable to consolidate their conquests and crush the tottering Manchu regime.

The turning point of the rebellion came when, in 1860, the imperial government commissioned the American adventurer Frederick Townsend Ward (q.v.) to organize and train its troops. Ward's forces, known in Chinese history as "the Ever-Victorious Army", re-

peatedly defeated the rebels during the next two years. Following Ward's death (1862), command of the Ever-Victorious Army passed to the British adventurer Charles George Gordon (q.v.). His campaigns against the rebels were uniformly successful. By July, 1864, Nanking had been recaptured and the rebel armies completely smashed.

**TAIRA.** See GRISON.

**TAIRA**, a Japanese clan of imperial descent, one of the four great families, Fujiwara, Minamoto, and Tokugawa being the others, which have been most distinguished in the history of Japan. The Taira family was established in the 9th century, when some of its members were given the control of provinces in the west. In 814 another house, the Minamoto, also of imperial descent, had been put in control in the east. For centuries the Taira and the Minamoto were content in their respective spheres, but in the 12th century they came into conflict over the succession to the imperial throne. The head of the Taira was Kiyomori, a man of great ability and of large experience in warfare. He was successful in his plans, defeated the Minamoto, and made himself supreme in the empire. He took the office of prime minister from the Fujiwara family, married his daughter to the emperor, filled all important offices with his clansmen, humiliated the Fujiwara nobles, and attempted the extermination of the Minamoto family. After his death, in 1181, the Minamoto clan obtained possession of the eastern part of Japan and then of Kyoto. The Taira retreated westward, were pursued by Yoshitsune, and finally defeated in 1185 in the sea fight of Dan-no-Ura. The clan was nearly exterminated and never regained its importance.

**TAIT, ARCHIBALD CAMPBELL** (1811-82), English clergyman, archbishop of Canterbury, born in Edinburgh, Scotland. In 1842 he was appointed successor to Dr. Arnold as headmaster of Rugby, in 1849 became dean of Carlisle, and in 1856 bishop of London, as successor to Blomfield. He was in 1868 made primate of all England by Disraeli.

**TAIT, JOHN ROBINSON** (1834-1909), American painter, born in Cincinnati, Ohio. His pictures are chiefly delineations of scenes in the Bavarian Tirol. They include "Landscape and Cattle", "Under the Willows", and a "Tirolese Cottage". He was for some years art critic of the New York *Mail and Express*.

**TAIT, SIR MELBOURNE McTAGGART** (1842-1917), Canadian jurist, born in Melbourne.

Australia. He was judge of the Superior Court (1887), acting chief justice, Montreal (1894), and from 1906 until 1912, when he retired, chief justice of the Superior Court, province of Quebec, Canada. In 1897 he was knighted.

**TAIT, PETER GUTHRIE** (1831-1901), Scottish physicist and mathematician, born in Dalkeith, and educated at Edinburgh and Cambridge universities. He was appointed professor of mathematics at Belfast University in 1854, and six years later became professor of natural philosophy at the University of Edinburgh, serving in that post until his death. Tait's most important mathematical studies dealt with the functions of quaternions (q.v.). In physics, he made notable contributions by his investigations of the physical properties of ozone, of the empirical bases for the kinetic theory (q.v.) of gases, and of the heat-producing potentialities of electricity. Among his works are *Elementary Treatise on Quaternions* (1867), *Heat* (1884), *Light* (1884), and *Properties of Matter* (1885).

**TAIT, ROBERT LAWSON** (1845-99), British gynecologist, born in Edinburgh. He settled in 1870 in Birmingham, where he became the leading gynecologist of his time and country. In 1879 Tait first excised the normal ovaries and thus became the pioneer in this kind of gynecological operation. Among many important operations, he introduced hepatoomy in 1880. He published numerous essays.

**TAIYÜANFU** or **YANGKU**, capital of Shansi Province, China, situated on the Fen R., about 240 miles s.w. of Peking, and served by the Peking-Hankow railway system. The surrounding region, a hilly plateau about 2500 ft. above sea level, contains productive coal and iron mines. Among the chief industries of the city are the manufacture of cotton textiles, iron, and military equipment. Taiyüanfu is surrounded by fortifications dating from the 14th century. Noteworthy points of interest include the Wan-Shou Kung ("palace of ten thousand ages") and Shansi University. The city was occupied by Japanese troops in 1937, during the Sino-Japanese war, and by Communist forces in 1949, during the Chinese civil war. Pop., about 200,000.

**TAJIK**, or **TADZHIK, SOVIET SOCIALIST REPUBLIC**, a constituent republic of the Union of Soviet Socialist Republics, situated in Soviet Central Asia (q.v.), bounded on the E. by Chinese Turkestan and on the S. by Afghanistan. It consists of the Garm,



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*The Taj Mahal at Agra, India, built in the 17th century*

Julyab, Leninabad and Stalinabad *oblasts* or regions, and the Gorno-Badkhschan Autonomous Region is included within its borders. The capital is Stalinabad (qv). About 75% of the population is comprised of Tatars, considered by ethnologists to be descended from the Avars, a branch of Turkic stock; most of them are Sunnite or orthodox Moslems. The territory forms a part of the high Pamir plateau, one of the Hindu Kush mountain ranges, and west of the Sulok range. Farming and the raising of livestock are the chief occupations of the people, and the wool from the republic supplies the Soviet Union with a large part of its cotton. Other crops include fruits, cereal grains, and sugar cane. Coal, lead, zinc, oil, and uranium are mined. Considerable industrialization has taken place since the beginning of World War II in 1939. The republic was created in 1924 as an autonomous soviet socialist republic, and in 1929 achieved its present political status. Area, 55,700 sq. m.; pop., about 1,485,000.

**TAJ MAHAL**, a mausoleum of white marble and alabaster at Agra, India, built by the Mogul emperor of Hindustan, Shah Jahan, between 1632 and 1650, as a burial

place for his favorite wife, Mumtaz Mahal. It has often been described as the most beautiful 17th century building in the world and is generally considered the supreme achievement of Mohammedan architecture. The Taj Mahal was probably planned by a Turkish or Persian architect called Ustad Isa. It consists of a square-domed structure of white marble 186 feet square and rising with the dome to a height of 210 feet. In the central chamber, above the vault in which the bodies of the Shah and his wife are buried, are two cenotaphs surrounded by an alabaster screen of open work inlaid with precious stones. The interior is lighted by the diffused daylight which filters through the translucent alabaster of the dome and through the perforated alabaster screens of the windows. The exterior is decorated with arabesques and passages from the Koran, inlaid with gems. The building, situated upon a terrace at the corners of which stand four slender cylindrical minarets, 133 feet in height, the terrace in turn is set in a square enclosure which contains a rectangular lake lying before the Taj itself, a gateway of red sandstone and white marble, and two mosques built of the same materials.

**TAKADA** or **TAKATA**, city of Niigata Prefecture, Honshu I., Japan, situated about 65 miles E.N.E. of Toyama. Pop., about 36,000.

**TAKAMATSU**, seaport and capital of Kagawa Prefecture, Shikoku I., Japan, situated about 80 miles S.S.E. of Osaka. It is the site of a ruined castle. Pop., about 73,000.

**TAKAMINE**, **JOKEICHI** (1854-1922), Japanese-American chemist, born in Takaoka, Japan, and educated at the universities of Tokyo and Glasgow. In 1881 he was made chief chemist of the Japanese Department of Agriculture and Commerce and later was assistant commissioner of the Patent Office. In 1890 he came to the United States and established a research laboratory at Clifton, N.J. He gave much attention to the study of diastatic ferments and produced takadiastase, used as a starch digestant. With Thomas Bell Aldrich he also isolated adrenalin (q.v.).

**TAKAOKA**, city of Toyama Prefecture, Honshu I., Japan, situated about 120 miles N.N.E. of Osaka. Bronze and lacquer ware are manufactured. Pop., about 122,000.

**TAKASAKI**, city of Gumma Prefecture, Honshu I., Japan, situated about 70 miles N.N.W. of Yokohama. It is a center of trade in silk. Pop., about 80,000.

**TAKIN** or **GNU GOAT**, common name applied to an unusual goat antelope (q.v.), *Budorcas taxicolor*, native to eastern Tibet and neighboring regions. The takin is a heavily-built animal, with coarse, buff-colored hair, it has large, hollow, curved horns similar to those of the gnu (q.v.). In habits the takin closely resembles its nearest relative, the serow (q.v.).

**TAKLA-MAKAN DESERT**, desert of central Asia in Chinese Turkestan, lying between the northern base of the Kuon-lun Mts. and the Tarim River. On the south it is bounded by the oases stretching to the foot of the mountains bordering the great plateau of Tibet. It stretches some 600 m. from east to west, 250 m. from north to south, and has an area of about 115,000 sq.m. Formerly it was a fertile region and a center of Buddhist civilization, of which many remains have been found.

**TAKOMA PARK**, a town of Montgomery and Prince Georges counties, Md., situated on the N. boundary of the District of Columbia, about 7 m. by rail N. of Washington, D.C. Pop. (1950) 13,341.

**TAKORADI**, chief seaport of the Gold Coast, British West Africa, situated on the

Gulf of Guinea, about 100 miles S.W. of Accra and 3 m. by rail W. of Sekondi. Takoradi possesses the only deep-water harbor on the 1300 miles of coast between Sierra Leone and Nigeria. In addition, the city is the terminus of a railroad from Kumasi, the capital of Ashanti colony. The port of Takoradi, which is excellently equipped, can handle as much as 5000 tons of cargo a day. The harbor possesses an enclosed area of 270 acres formed by two breakwaters. The main breakwater lies about four miles from shore and consists of a reef and an artificial barrier one and a half miles long. Ships drawing up to 40 ft. of water can berth in the spacious harbor. Construction on the wharves and breakwaters of the harbor was begun in 1921 and completed in 1928. Since that time the port of Sekondi, which possesses an open roadstead, has been eclipsed by Takoradi. The principal exports from Takoradi are cacao beans, manganese ore, and logs, chiefly mahogany. Pop., about 50,000.

**TALAL I** (1909- ), King of Jordan, born in Mecca, and educated at the Royal Military College, Sandhurst, England. He ascended the throne on Sept. 5, 1951, following the assassination of his father King Abdullah Ibn-Hussein. The victim of a severe mental ailment, he was removed from the throne by the parliament of Jordan on Aug. 11, 1952. His son Hussein (1934- ) was proclaimed king the same day.

**TALAMANCANS**, tribe of Central American Indians of Chibcha stock, who dwelt formerly in Costa Rica and Panama. They had many of the characteristics of the Mayas of Yucatan.

**TALavera DE LA REINA**, ancient town of Spain, in the province of Toledo, on the Tagus, 75 m. from Madrid by railroad. It manufactures pottery, and still holds a famous fair in August. On July 27-28, 1809 Wellington and the Spanish forces defeated Joseph Bonaparte there. Pop., about 13,000.

**TALBOT**, **ETHELBERT** (1848-1928), American clergyman, born in Fayette, Mo. He was rector, St. James' Church, Macon, Mo.; headmaster, St. James' Military Academy, Macon, Mo. (1873-87); and bishop of Wyoming and Idaho (1887).

In 1898 Talbot was elected bishop of Central Pennsylvania. In 1905 his diocese was divided, and he remained as bishop of Bethlehem, Pa. On Feb. 15, 1924, he became, by succession, presiding bishop of the Protestant Episcopal Church. Talbot resigned from his bishopric Oct. 1, 1927.



**TALBOT, HENRY PAUL** (1864-1927), American chemist and educator, born in Boston. His entire professional career was spent in the department of chemistry of the Massachusetts Institute of Technology, of which he became head, and he was also chairman of the faculty, and after 1921 dean of students. During 1892-94 he lectured on chemistry at Wellesley College and during World War I he was a member of the Advisory Board of the United States Bureau of Mines for chemical research connected with gas defense.

**TALBOT, SILAS** (1751-1813), American naval officer, born in Dighton, Bristol County, Mass. He took part in the Revolutionary operations around Boston, captured the *Dragon*, and was eventually captured (1780) with his ship the *George Washington*. The outbreak of war with France (1793) sent him cruising to the West Indies on the *Constitution*. He later retired from the service (1801).

**TALBOT, WILLIAM HENRY FOX** (1800-77), English physicist and philosopher, known as one of the pioneers in photography. He was educated at Cambridge University and for a short time was member of Parliament for Chippenham. He first attempted to fix shadows, and in his research he discovered a process of obtaining and fixing sun pictures. On the dissemination of a report as to Daguerre's successes in the same field, Talbot wrote a paper published in the *Philosophical Magazine* in March 1839, in which the successive steps of his investigation and their result were detailed. This process was subsequently improved by his invention (1841) of the calotype process. His discoveries and inventions in photography are described in his *Penetrations of Nature* (1844-45). In later life he devoted himself to the study of philosophy and archaeology and was one of the first to read the cuneiform inscriptions of Nineveh. Among his works are *Hermes, or Critical and Antiquarian Researches* (1828-39), *Illustrations of the Antiquity of the Book of Genesis* (1839), and a work on *English Etymology* (1846). See CALOTYPE, PHOTOGRAPHY.

**TALC**, a soft, greasy, granular or fibrous mineral composed of a hydrous magnesium silicate,  $Mg_3Si_2O_{10}(OH)_2$ , and crystallizing in the monoclinic and orthorhombic systems. It has a hardness of 1 to 1.5, a specific gravity of 2.6 to 2.8, and exhibits perfect basal cleavage. The mineral ranges in color from



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apple green, gray or white to silver white, and luster with a pearly to greasy luster. Talc is an exceedingly common mineral and occurs in huge beds of crystalline schists together with chlorite, serpentinite and dolomite (qqv). More often it is found in metamorphic rocks in banded or granular, compact form known as scapolite (qv) or soapstone. The principal deposits occur in the United States and are worked extensively in California, Georgia, North Carolina, Vermont, Massachusetts, Rhode Island, New Jersey, New York and Pennsylvania. Because of its great softness, its resistance and its workability talc was widely used in the manufacture of pottery in ancient times, and has often been called potstone. It serves as an ingredient in cements, lubricants and pigments, and is used for slate pencils and talcum powder. The mineral is still employed by the Chinese for many of their ornamental carvings.

**TALCA**, province of Chile, bounded on the west by the Pacific, on the east by the Argentine Republic, on the north by Curico, and on the south by Linares. It is mountainous but with fertile valleys. Wheat in large quantities is grown and livestock raised, and the mountains have valuable timber forests. It is drained by the river Claro. The capital is Talca. Woolen mills are the chief source of trade. Area, 3,211 sq m, pop. (1950 est.) 169,792.

**TALCA**, capital of Talca Province, Chile, on the river Claro, a tributary of the river Maule, 170 miles s. of Valparaiso. There are woolen mills where ponchos are made in large numbers. Pop. (1952) 63,602.

**TALCAHUANO**, a seaport in Concepción Province, Chile, situated on Talcahuano Bay in the Pacific Ocean, 260 miles s. of Valparaiso, and 8 miles n.w. of the city of Concepción, for which it is the port. The harbor, the finest along the Pacific coast of South America, accommodates ships of 30,000 tons. The principal industry is the exportation of grain, chiefly wheat. The city is connected by rail to Concepción, Santiago, and Valdivia. Talcahuano is also the site of the principal Chilean naval base. In 1835 an earthquake damaged the city severely. Pop. (1952) 63,133.

**TALENT**, the heaviest unit of weight and value among the ancient Greeks, the equivalent of 60 minæ and 6000 drachmæ (see *DRACHMA*). Although the name was Greek, the unit of weight came from Babylonia and Phœnicia. Considerable variations in the value of the talent existed among the different Greek states.

**TALENTI**, the name of two Florentine architects, father and son. 1. **FRANCESCO TALENTI** (1305—about 1370), born in Pontelieve, near Florence. He was employed as early as 1329 on the cathedral of Orvieto. He appears to have succeeded Taddeo Gaddi as architect of the campanile of the cathedral of Florence, begun by Giotto (q.v.), of which Talenti built the upper three stories. In 1555 he was employed to make a new and enlarged design for the nave of the cathedral, which was built after his model and nearly completed at his death.

2. **SIMONE TALENTI** (birth and death dates unknown), son of the above. He assisted his father in preparing the model for, and in 1375 was appointed chief architect of, the cathedral of Florence. In association with Benci di Cione, Simone designed the Loggia dei Lanzi and supervised the greater part of its erection. He also designed the lower part, at least, of the church of Or San Michele.

**TALE-SAP**, or **TONLÉ SAP**, lake in Cambodia (Indochina) connected with the Mekong by the Bras du Lac Channel, 70 m. long. In the dry season its area shrinks to 100 sq.m., and its depth from 6 to 2 ft.

**TALES OF HOFFMANN**, opera in three acts, a prologue, and an epilogue, by the French composer Jacques Offenbach, with a libretto by the French writer Paul Jules

Barbier. The opera was first presented in Paris on February 10, 1881, four months after the composer's death; its first American performance was given on October 16, 1882, in New York City. There are several versions of the text and music of this opera, on which Offenbach worked for many years; the most frequently performed libretto is summarized in this article.

The scene of the prologue is laid at Nuremberg during the early 19th century, in a tavern at which the poet Hoffmann and his student friends are gathered. They persuade him to tell the stories of his three love affairs, which are represented in each of the succeeding acts. Act One takes place in a ballroom in the home of Spalanzani, an Italian savant who, with the help of the evil trickster Coppélius, has constructed a life-sized mechanical doll which he exhibits as his beautiful daughter Olympia. Hoffmann falls in love with Olympia, who is unresponsive. They dance together but Hoffmann cannot keep up with the doll, which dances faster and faster. Hoffmann swoons and Olympia is guided from the room. Soon a cracking noise is heard. Coppélius has smashed the doll in his quarrel with Spalanzani over the cost of the automaton. On stage, Hoffmann mourns the unhappy ending to his first love.

Act Two finds Hoffmann before the home of Giulietta, a beautiful Venetian courtesan with whom he is fascinated. She loves Schlemiel, and both are under the influence of the evil magician Dapertutto, who hopes to obtain, through Giulietta, Hoffmann's soul also. Giulietta promises Hoffmann the key to her bedroom if he fights a duel with Schlemiel, who now has the key. Using the sword Dapertutto offers him, Hoffmann kills Schlemiel, but a moment later hears Giulietta's mocking laugh as she glides down the canal in her gondola in Dapertutto's arms. Act Three describes his third love, the lovely, frail Antonia, daughter of Crespel and a famous singer who died of consumption. Crespel forbids his daughter to use her exquisite voice because of her inherited weakness, but Dr. Miracle, the same evil genius who haunted Hoffmann as Coppélius and Dapertutto, shows the girl a vision of her mother, and persuades her to sing. Antonia sings divinely, and then, exhausted, sinks dying in Hoffmann's arms. The epilogue takes place in the tavern where Hoffmann, his tales ended, is left alone. He falls asleep, dreaming of the Muse of Poetry, the only true love for him.

**TALFOURD, SIR THOMAS NOON** (1795-1854), English lawyer and author, born in Reading in Berkshire. He studied law and was called to the bar at the Middle Temple (1821). Talfourd was eventually elected to the bench in the Court of Common Pleas (1849). His most famous case was a defense of Edward Moxon, who was prosecuted for publishing Percy Bysshe Shelley's *Queen Mab*. Entering Parliament in 1835, he championed the copyright bill (1837), which he himself had introduced. In recognition of his service *The Pickwick Papers* (1836-37) by the English novelist Charles Dickens was dedicated to him. His name is especially associated with that of the English essayist Charles Lamb through two of Moxon's books, *Letters of Charles Lamb with a Sketch of His Life* (1837) and *Final Memorials of Charles Lamb* (1848). In 1875 these two books were published together under the title *Memoirs of Charles Lamb*. Talfourd's great literary success was *Ion* (1836), a tragedy. It was followed by *The Athenian Captive* (1838) and *Glencoe* (1840).

**TALIAFERRO, MABEL** (1887- ), American actress, born in New York City. She first appeared on the stage when two years old and played child parts with J.A. Herne in *Shore Acres*, and with Chauncey Olcott. She attracted notice as Esther Ansell in *The Children of the Ghetto* (1899). She also appeared in *Mrs. Wiggs of the Cabbage Patch* (1903), *Polly of the Circus* (1907), *Alice in Wonderland* (1920), *The Old Maid* (1936), and *The Children's Hour* (1937).

**TALIESIN** (fl. middle of 6th century A.D.), British bard. Nothing definite is known as to his career, and some scholars hold that he is a mythical personage. According to legend he was called "the chief of the bards". The "Book of Taliesin" contains fifty-six poems, which were formerly attributed to Taliesin. All are now generally believed to be of a later date.

**TALIPOT PALM, OR GREAT FAN PALM**, common name for *Corypha umbraculifera*, one of the largest palms of the East Indies. Its straight cylindrical trunk 60 to 100 feet high, is crowned with a tuft of enormous palmate plaited leaves, divided near the outer margin into numerous segments, and united to the trunk by spiny leafstalks. The leaves are usually about 10 to 20 feet in diameter, exclusive of the leafstalk, which is 7 or 8 feet long. At the age of 30 or 40 years the tree produces a long pyramidal cluster of whitish flowers, rising to the height of 30

feet from the first of its crown of leaves, and dividing into simple alternate branches, the lower of which sometimes extend laterally 20 feet. After maturing the numerous globose fruits, about 1½ inches in diameter, the tree generally dies. The leaves are used for covering houses, for making tents, and for many other purposes. The leaves of this palm are used in Malabar as a substitute for paper, and are prepared by boiling, drying, damping, rubbing, and pressing. The soft central part of the stem yields a kind of sago. The large ivorylike seeds are used for making buttons and ornaments.

**TALISMAN**, astrological charm or symbol supposed to benefit the possessor, thus any amulet. See AMULET.

**TALLADEGA**, county seat of Talladega Co., Ala., situated 57 miles E. of Birmingham, in the foothills of the Blue Ridge Mountains. It is served by three railroads, and is the center of a rich farming, dairying, and mineral-producing region. Cotton, dairy products, iron, limestone, and marble are the chief products of the surrounding area. Industrial establishments in the city include cotton-textile mills, cottonseed-oil mills, lumber mills, and factories manufacturing machine parts of and soil pipe and fittings. Talladega is the site of Talladega College (Congregational), for Negroes, established in 1867, of the Alabama Institutes for the Deaf and Blind, and of the Alabama School for the Deaf, Dumb and Blind, for Negroes. In the vicinity of the city are Talladega National Forest and several mineral springs. Talladega was the site of a battle on Nov. 7, 1813, between an American force and Gen. Andrew Jackson and a large force of hostile Creek Indians who were besieging a fort occupied by a small band of friendly Indians. Jackson and his troops won a decisive victory in which about 290 of the hostile Indians were killed and the power of the Creek Confederacy was weakened. Pop. (1950) 13,134.

**TALLAGE**, name applied to those taxes to which, under the Anglo-Norman kings, the demesne lands of the crown and all royal towns were subject.

**TALLAHASSEE**, capital of Florida and county seat of Leon Co., situated 20 miles N. of Gulf of Mexico and 166 miles W. of Jacksonville. It is served by two railroads, and by three air lines at the municipal airport. Tallahassee is the trading center and shipping and distributing point of a wide agricultural and lumbering area. The principal agricultural industries in the region are dairy-



*Charles Maurice de Talleyrand-Périgord*

ing, the raising of livestock and poultry, and the cultivation of fruits, nuts, cotton, tobacco, sugar cane, and tung trees. The leading industries in the city are the manufacture of naval stores, lumber, packing boxes and other wood products, and machinery. Among the educational and cultural institutions in Tallahassee are Florida State University (q.v.), the Florida State Agricultural and Mechanical College, for Negroes, established in 1887, the State Geological Museum, the State College Library, and Walker Memorial Library, housing relics of Prince Napoleon Achille Murat, who settled at Tallahassee in 1821. The State Capitol, the central part of which was completed in 1845, with several wings later added, the State Supreme Court and Library, and the Governor's Mansion are the principal public buildings.

Tallahassee is surrounded by rolling hills and wooded areas containing giant magnolia trees and live oaks, draped in Spanish moss. In the city and vicinity are many old mansions and plantations, notably "The Grove", built in 1825 by a former governor of Florida. Lakes and streams abound in the region, and the city is headquarters of the Apalachicola National Forest. The site of Tallahassee was first settled about 1818 and in 1824 the settlement was selected as the capital of the Territory of Florida. Pop (1950) 27,237.

**TALLAPOOSA**, a city of Haralson Co., Ga., situated about 55 miles w. of Atlanta. The city is served by rail. It is the center of

an agricultural and lumbering area; cotton and general farm crops are cultivated and pine forests abound in the region. The principal industries in the city are the manufacture of thread, shirts, furniture, and Venetian blinds. Tallapoosa was incorporated in 1860. Pop (1950) 2826.

**TALLAPOOSA RIVER**, river rising in Paulding County, Ga., and flowing southwest through Harrison County, across the boundary into Alabama, and across Cleburne, Randolph, Tallapoosa, and Elmore counties in the same direction. It receives the Little Tallapoosa in Randolph County, and after 260 m. enters the Alabama River near Montgomery.

**TALLEMANT DES RÉAUX, GÉDÉON** (1619-92), French writer, born in La Rochelle. He took his degrees in law, but refused to go into the magistracy. He employed his leisure in literary work, wrote verses in the taste of the time, and began a tragedy of *Oedipe*. Tallemant is chiefly remembered for his *Historiettes*, a series of biographical, anecdotal, and character sketches of contemporaries. Light, witty, cynical, less restrained than modern taste demands, they are an invaluable document of the period.

**TALLEY, MARION (NEVADA)** (1906- ), American coloratura soprano, born in Nevada, Mo. Without any previous stage experience, she made her debut as Gilda in *Rigoletto* (Feb. 17, 1926), at the Metropolitan Opera House. Three years later, Marion Talley created a second sensation, when she retired from the stage as suddenly as she had appeared. She made her farewell appearance in the title role of Thomas's *Mignon* (May 6, 1929) in Cleveland, when the Metropolitan Company was making its annual spring tour. Shortly afterward she took up her residence on a farm she had purchased in Missouri. In 1931 she appeared in a single radio concert broadcast from New York City. She later returned to the concert stage, also appearing in several motion pictures.

**TALLEYRAND-PÉRIGORD, CHARLES MAURICE DE, PRINCE DE BÉNÉVENT** (1754-1838), French politician, born in Paris. However, there has always been some question as to the exact date and place of his birth. He obtained the abbacy of St. Denis in 1775, and five years later was appointed *agent-général* to the French clergy; finally, Louis XVI appointed him bishop of Autun in 1789. In the same year the clergy of his diocese elected him to represent them in the States-general. In April he was excommunicated by

the pope and he gave up his clerical career. In 1792 his connection with the Revolution ended by his being placed on the list of *émigrés*. After the fall of Robespierre he returned to Paris in 1795, joined Barras' party, and in 1797 he was made foreign minister under the Directory, serving until 1807.

He was greatly instrumental in consolidating the power of Napoleon I (1802) as consul for life and then (1804) as emperor. After his creation as a prince of the empire under the title of Prince of Bénévent, he withdrew from the ministry. The failure of Napoleon's designs in Spain was, however, the occasion of the first real rupture between him and Talleyrand.

During the revolution of July, 1833, he was Louis-Philippe's chief advisor. He went to London as ambassador, reconciled the British ministry and court to France, and returned to Paris, later to retire to private life in 1834.

**TALLIEN**, JEAN LAMBERT (1769-1820), French Revolutionist, born in Paris. He became famous in the first months of 1791 by his Jacobin broadsheet, *L'Ami des Citoyens*. He was conspicuous in the attack on the Tuileries (August 10), and became secretary to the Commune Insurrectionnelle. On March 22, 1794, he was chosen president of the Convention. Tallien helped suppress the Revolutionary Tribunal and the Jacobin Club and drew up the accusations against Carrier. Le Bon, and others of the Terrorists.

**TALLIEN**, JIANNIE MARIE IGNAZ THÉRÉSA, nee CABARRÚS (1773-1835), daughter of the Comte de Cabarrús, minister of finance in Spain. She was married at the age of sixteen to the Marquis de Fontenay, but was divorced from him in 1793 and in the same year married Tallien, the French revolutionist, whom she induced to engage in a plot for the overthrow of Robespierre, thus becoming one of the chief promoters of the Revolution of July, 1794. After a second divorce (1802) she married in 1805 the Comte de Caraman, afterward the Prince de Chimay. Though a ranking beauty, she was never admitted to court circles.

**TALLINN**, or REVAL, capital and leading seaport of Estonia, situated on the Bay of Tallinn, an inlet on the s. coast of the Gulf of Finland, about 230 miles w.s.w. of Leningrad. The town consists of the upper town, or *Toompea* ("Cathedral Hill"), and the old lower town, which contained many medieval buildings but was largely destroyed during World War II. The harbor, which accommodates vessels with a maximum draught of

30 ft.; is often frozen for more than forty days a year. The principal port exports of the port included butter, flax, textiles, lumber, paper, and cement; imports were chiefly cotton, coal, iron and steel, sugar, superphosphate, and agricultural machinery. In 1936 the share of Tallinn in overseas traffic amounted to 1589 vessels and 952,532 net registered tons. A settlement existed on the site of Tallinn as early as 1093, and in 1284 the town joined the Hanseatic League and soon attained considerable commercial importance. In 1346 it was sold by Denmark, then in control, to the Teutonic Knights. Sweden acquired it in 1561, and Peter the Great annexed it to Russia in 1710. A Russian naval station was constructed there, beginning in 1910, and the city, known as Reval, became the chief naval base for the Russian Baltic fleet. After Estonia became an independent republic in 1918, the harbor was greatly improved. Pop. (1937) 145,755.

**TALLIS**, THOMAS (about 1510-85), English musician, called the father of English cathedral music. About 1542 he was appointed gentleman of the chapel royal and served under Henry VIII, Edward VI, and the queens Mary and Elizabeth. He was also organist to Elizabeth. Tallis, besides writing a large number of anthems, responses, and Te Deums, was the author of a celebrated work, *Song of the Forty Parts*, composed for eight choirs of five voices each.

**TALLITH** (Aramaic, *tēlal*, "to cover"), in the Jewish religion, a type of undergarment worn by orthodox Jews. The tallith covers the chest and the upper portion of the back: it has an opening for the head, and has fringes (q.v.), or *tzitzit*, suspended from its four corners. The term "tallith" is also employed to designate a fringed ceremonial scarf or shawl worn over the head or across the shoulders, usually during morning devotions, by orthodox Jews.

**TALLMADGE**, a village of Summit Co., Ohio, situated on the E. boundary of Akron, of which it is a suburb. Transportation facilities include a railroad. Pop. (1950) 5821.

**TALLMADGE**, BENJAMIN (1754-1835), American soldier, born in Brookhaven, N.Y. Appointed captain of dragoons (1776), he rendered distinguished service at Brandywine and Germantown, and captured 500 Tory marauders at Lloyd's Neck, L.I., without the loss of a man (1779). An intimate of Washington, he had custody of Major André and accompanied him to the scaffold, and has left an eloquent tribute to his personal qualities.

**TALLMADGE, NATHANIEL FITCHER** (1795-1864), American legislator, born in Chatham, N.Y. After serving on the State legislature he was a member of the United States Senate (1833-44). This he resigned on his appointment as governor of Wisconsin territory (1844). He was removed from office two years later.

**TALLOW.** See **FATS AND FIXED OILS.**

**TALLOW TREE,** or **VEGETABLE TALLOW,** common name applied to a tall, tropical tree, common name applied to a tall, tropical tree, *Sapium sebiferum*, belonging to the Spurge family. The tree is native to the warmer parts of China, and is cultivated in many tropical lands for its fruit, which yields the vegetable tallow commonly called Chinese tallow or Chinese vegetable tallow, used in the production of candles and soap. Its hard wood is used in wood engraving. The tallow tree attains a height of 30 feet, and is characterized by the brilliant red of its broad leaves.

**TALLULAH,** parish seat of Madison Parish, La., situated near the Mississippi R., about 20 m. by rail n.w. of Vicksburg, Miss. Transportation facilities include two railroads and an airport. The village is the center of an agricultural area in which cotton, corn, hay, oats, and vegetables are the chief crops. Among the industrial establishments in Tallulah are a cotton gin and a cottonseed-oil mill. Tallulah is the site of a U.S. Agricultural Experimental Station, at which methods of raising cotton and means of controlling cotton pests such as the boll weevil are studied. Pop. (1950) 7758.

**TALLY,** term applied to a rod or stick, marked with notches to indicate a certain sum, and then cut lengthwise into two, so that the parts when brought together will agree. The English exchequer employed tallies till 1783, the officers having charge thereof being called tellers (*talliers*).

**TALMA, FRANÇOIS JOSEPH** (1763-1826), French tragedian, born in Paris. He made his debut in 1787 at the Comédie-Française as Séide in *Mahomet*, but his first great success was his innovation in costume when playing Proculus in the tragedy of *Brutus*. At the Théâtre de la République he appeared throughout the Revolution in such characters as the title role in *Othello*, Nero in *Epicharis et Neron*, and Ægistheus in *Agamemnon*.

**TALMAGE, THOMAS DE WITT** (1832-1902), American clergyman, born in Bound Brook, N.J. From 1859 to 1869, he was pastor of churches in Syracuse, N.Y., and Philadelphia, Pa. In 1869 he became pastor

of the Central Presbyterian Church in Brooklyn, N.Y., and in the following year his congregation erected the Brooklyn Tabernacle, with a seating capacity of nearly four thousand. This building was destroyed by fire in 1872, and successive structures were also burned in 1889 and 1894. From 1895 to 1899 he was associate pastor of the first Presbyterian Church in Washington, D.C. For many years he was well known as a lecturer in the United States and in Europe. From 1873 to 1902 he was successively editor of the *Christian at Work*, the *Advance*, *Frank Leslie's Sunday Magazine*, and the *Christian Herald*. His *Autobiography* appeared in 1912.

**TALMUD,** that body of Jewish civil and religious law, together with the commentaries relating thereto, not comprised in the Pentateuch. It exists in two great collections and includes the Mishna and Gemara.

The *Palestinian Talmud*, sometimes more popularly called the *Jerusalem Talmud*, contains the discussions on the Mishna of the Palestinian scholars from the 2nd to the middle of the 5th century.

The *Babylonian Talmud* embodied the teachings of the Jewish scholars in Babylonia from about 190 to the 7th century.

The legends, anecdotes, or sayings in the Talmud, illustrative of the Law, are called *hagada*, while the name *halaka* is given to the decisions of the Talmudists on disputed questions.

The history of the Talmud is the history of Judaism from about the beginning of our era to the dawn of the nineteenth century.

The best commentaries of the Mishna are by Maimonides and Bartenora, and of the Babylonian Talmud by Rashi and the Tosafists of France and Germany. An abstract of the Talmud for legal purposes by Maimonides is called *Mishne Thorah*. The Mishna was first printed in Naples, 1492; the Talmud of Jerusalem in Venice, by D. Bomberg, 1523. The Babylonian Talmud was first published in Venice by him in 1520.

**TALON, JEAN BAPTISTE** (1625-91), French colonial official, born in Picardy. In 1663 he was appointed intendant of justice, police, and finance of Canada and other North American possessions of the crown. In the course of his administration he established trade between Canada and the West Indies, built the first brewery in North America, created a number of other industries, and effected many reforms. He also urged the purchase or seizure of New York. In 1668 ill-health compelled him to return to France,

but in 1670 he again assumed the intendency, which he held until 1672. Later he took the title of Comte d'Orsainville.

**TALOS**, in Greek mythology, a gigantic man of bronze, made by Hephaestus, god of fire, and presented to Minos (q.v.), King of Crete. As defender of the island, Talos, heating himself red hot, killed strangers by embracing them as they arrived. When the Argonauts (q.v.) landed on Crete, Talos was captured by the heroes Castor and Pollux and slain by the sorceress Medea (q.v.), who by magic pulled out the stopper in his foot so that his vital fluid drained out.

**TALPA**. See MOLE.

**TALTAL**, seaport of Chile, situated in the province of Antofagasta, 125 miles s. of the city of Antofagasta. Nitrates and ores are exported. Pop., about 7000.

**TALUS**, term employed in geology to designate the sloping heap which accumulates at the base of a rock or precipice, from fragments broken off by the weather, or materials in any way carried over it.

**TAMA**, a city of Tama Co., Iowa, situated on the Iowa R., about 60 miles N.E. of Des Moines. It is served by two railroads. Among the industrial establishments in the city are a wood preserving plant, a paper mill, a creamery, and a chick hatchery. The Sac and Fox Indian Reservation, established in 1896 and covering more than 3200 acres, lies to the W. of the city. Pop. (1950) 2930.

**TAMANDUA**, town of Brazil, in the State of Minas Gerais, 150 m. from Ouro Preto. Cotton is cultivated in the vicinity. Pop., about 8000.

**TAMAQUA**, borough of Schuylkill Co., Pa., on the Tamaqua or Little Schuylkill River, 134 m. from New York. The industrial products include the manufacture of shirts, hosiery, and shoes. Coal is also mined in the vicinity. Pop. (1950) 11,508.

**TAMARACK**. See LARCH.

**TAMARIN**. See MARMOSET.

**TAMARIND** (Arabic fr. *tamr hindi*, "Indian date"), common name for a tropical, evergreen tree, *Tamarindus indica*, belonging to the Pea family, and native to fertile areas throughout tropical Africa and southern Asia. The tamarind is a large tree, attaining a height of 80 feet. Its wood is extremely hard, and is used in cabinetwork. The tamarind is cultivated widely in tropical areas of the Eastern and Western hemispheres as an ornamental tree and for its acid fruits. The pale-yellow flowers, arranged in loose, terminal racemes, have a four-parted calyx, five petals,

three fertile stamens, and a solitary pistil. The fruit is a tapering, indehiscent, many-seeded pod. In medicine, the fleshy fruit pulp is used by Hindus in several areas as a refrigerant, laxative, antiscorbutic, and digestive. Mixed with sugar and water, the juice of the fruit makes a cooling drink popular in Latin America.

**TAMARISK**, common name applied to deciduous trees and shrubs constituting the genus *Tamarix* of the family Tamaricaceae. Plants of the genus, which contains approximately 75 species, are native to southern Asia and the Mediterranean region, and are cultivated as windbreaks in many seashore areas of the United States. The showy pink or whitish flowers, arranged in terminal panicles or racemes, have four or five sepals, four or five petals, four or five stamens, and a solitary pistil. The fruit is a dehiscent, many-seeded capsule. One of the hardiest species of tamarisk is *T. parviflora*, a pink-flowered shrub or small tree growing to a height of 15 feet, native to s. Europe. *T. pentandra*, native to s.e. Europe and central Asia, is common along the Massachusetts coast, and is similar in appearance to *T. parviflora*. A larger variety, *T. tetrandra*, grows to a height of 12 feet. It is native to and cultivated in s.e. Europe and w. Asia. It bears pinkish-white flowers and has dark-gray bark. *T. odessana*, a small shrub approximately 6 feet in height, is a pink-flowered variety native to coastlands surrounding the Caspian Sea and naturalized along the Atlantic coast in New England. A 30-foot tree, *T. articulata* is often used as a windbreak in the dryer regions of California. Several species of tamarisk have important medicinal properties, and others are cultivated for their dye products. Tamarisk galls, rich in tannin, are produced by members of *T. articulata*. An oriental species, *T. mannifera*, excretes an inedible resin, called "manna", from wounds resulting from insect punctures. The German tamarisk or false tamarisk, *Myricaria germanica*, is a closely related tree native to w. Europe.

**TAMARIX**. See TAMARISK.

**TAMATAVE**, an important trading port of Madagascar, on the E. coast. It is connected with Antananariva, and with other interior points, by rail, and conducts most of the foreign trade of Madagascar. Pop. (1950) 28,747.

**TAMAULIPAS**, the northernmost of the Gulf States of Mexico, with part of its low coast bordered by the southern Laguna del Madre. Exports include hides and livestock,

copper, and asphalt. The capital is Ciudad Victoria. Area, 30,731 sq.m.; pop. (1950) 716,029.

**TAMAYO Y BAUS, MANUEL** (1829-98), Spanish dramatist, born in Madrid of parents both of whose families were distinguished in the annals of the stage. His early life was passed in traveling about the provinces with the company of which his parents were members. He was a lifelong friend of Manuel Cañete (q.v.). He was elected (1858) to the Spanish Royal Academy, of which he became permanent secretary in 1874. From 1884 till his death he was director of the National Library and chief of the board of archivists, librarians, and antiquarians. When Tamayo y Baus was only eleven years old, he made a translation or adaptation of *Geneviève de Brabant* which was successfully staged, with his mother in the title role, at Granada. His dramaturgic manifesto, *Truth as the Fountain of Beauty in Dramatic Literature* (1858), was widely influential. His most important plays are *La Locura de Amor* (1855), dealing with the madness of Juana la Loca, the daughter of Ferdinand and Isabella; *Lances de Honor* (1863), treating of the evil of dueling; and *Un Drama Nuevo* (1867), a perfect example of the incorporation of a play within a play. By most critics *Un Drama Nuevo* is considered not only Tamayo's masterpiece, but also one of the great plays of all literature.

**TAMBOUR** (Fr., "drum"), in fortification, a small traverse to prevent the enfilade of a trench, or in other words, a small work projecting from the main line of a fortification, often in the form of a redan or a lunette with a salient angle of about 60°. In older schemes of fortification the tambour usually consisted of a timber structure or stockade with loopholes to protect the gateway of an approaching road, or afford a flanking fire on a bridge. In formal schemes of fortification, the tambour on the covered way was used to close the entrance from the glacis. See FORTIFICATION AND SIEGE CRAFT.

**TAMBOURIN** (Fr. *tambourine*, dim. of *tambour*, "drum", "tabor"), an ancient, lively dance of Provence, in  $\frac{3}{4}$  time. It was originally accompanied by a flute and a tambour (drum), hence the name.

**TAMBOURINE**, an ancient instrument of the drum species. It is composed of a piece of parchment stretched on the top of a hoop furnished with little bells or small metal disks, and is sounded by the hand, fingers, or elbow.

**TAMBOV**, administrative center of the Region of the same name in the Russian Soviet Federated Socialist Republic. The city is situated on the Tsna R., about 300 miles s.e. of Moscow. Its industrial establishments include distilleries, brick works, metal smelters, and flour mills. Tambov was founded in 1636 as a Russian fortress for protection against raids by Tatars and Kalmucks from the s. In 1695-96 part of the Russian army was based there during the assault of Peter the Great on the (then) Turkish fortress of Azov. The Tambov Region, included in the so-called Central Black Earth Area, is a fertile plain traversed by many river valleys. The principal crops are rye, oats, flax, tobacco, and sugar beets. Area, 13,745 sq.m.; pop., about 1,882,000. Pop. of city, about 121,000.

**TAMERLANE** or **TAMBURLAINE**, Eng corrupted forms of TIMUR LENK ("Timur the Lame"), called also TIMOUR or TIMUR (1336?-1405), Mongol conqueror, born in Kesh, some 50 miles s. of Samarkand, the son of the chief of a Mongol clan. In 1369, having overcome all his rivals and enemies, Tamerlane then seated himself on the throne of Samarkand. The rest of his life, after he had organized the internal affairs of his kingdom, was spent in military campaigns, inspired by his lust of conquest. He subdued nearly all Persia (now Iran), Georgia, and the other Caucasian states by 1390. He conquered (1398) all the states between the Indus and the lower Ganges in India, and returned to Samarkand with a fabulous wealth of booty. He next subdued the Turks in Asia Minor; but first turned aside to win Damascus and other strong places in Syria from the Mameluke sovereigns of Egypt.

**TAMETOMO** (fl. 12th century A.D.), Japanese archer. He belonged to the great Minamoto family. He is credited with many feats of strength and skill. He sent an arrow through the body of one man and wounded a second who stood behind him. He shot an arrow through the helmet of his own brother without hurting him. Being taken prisoner and a sinew of his arm having been extracted by his foes, Tametomo came nevertheless to shoot a stronger bow and sank a boat by shooting an arrow through its bows. The accounts of his end are contradictory. According to some accounts, after sinking the boat he fired his house and committed suicide; in other accounts he fled to Ryukyu (Luchu) and became its king, the first of the historic line.



**TAMIL.** See INDIAN LANGUAGES.

**TAMMANY SOCIETY,** or **THE COLUMBIAN ORDER**, originally, a national patriotic and charitable society of the United States, devoted to the preservation of democratic institutions and specifically opposing the aristocratic theories advanced by the Federalists (see **FEDERALIST PARTY**). The Tammany Society is often referred to in popular parlance as "Tammany Hall", after the name of its New York City headquarters. Tammany was founded in New York City in 1789 by William Mooney, a former soldier of the American Revolutionary Armies and a prominent anti-Federalist. The name of the Society was adopted from that of the Indian chieftain Tammany, who was supposed to have concluded the treaty whereby William Penn (q.v.) acquired proprietorship over most of the area now called Pennsylvania. Tammany was originally organized into thirteen "tribes", one in each of the thirteen States; its officers were accorded Indian titles, such as "sachem" and "sagamore"; and its meeting-places were referred to as "wigwams". The motto of the Society was "Freedom Our Rock". The national character of Tammany was relatively short-lived; its association with New York City politics dates from the earliest years of the 19th century and, in the opinion of some historians, may be traced back even further.

In its early years, Tammany was associated with many successful struggles for the advancement of democracy in the United States, particularly the campaigns for the establishment of manhood suffrage without property qualifications and for the abolition of imprisonment for debt. Tammany also lent its support to the victorious struggle waged by President Andrew Jackson in the early 1830's against the Bank of the United States (see **BANK AND BANKING: U.S. Banking System**). The Society first attained a dominant political influence in New York City in 1850, when one of its leaders, Fernando Wood (q.v.), was elected mayor. About ten years later the notorious William Marcy Tweed (q.v.) was elected "grand sachem" or head of Tammany; his regime, which lasted until 1871, was marked by a notable rise in corruption in the municipal administration. Investigations and legal actions undertaken on the initiative of Samuel J. Tilden (q.v.), then chairman of the New York State Democratic Committee, led to the exposure and imprisonment of Tweed and the members of the "Tweed Ring", and

for a brief period to the political eclipse of Tammany.

The Society quickly re-established itself in public favor, however, and regained its influence in the city government. In 1886 Richard Croker (q.v.) was elected to the Tammany leadership; under his regis the Society became so powerful that in 1894 the New York State legislature appointed the Lexow Investigation Commission (q.v.) to inquire into the relationship between Tammany and the municipal administration, and to determine the extent of corruption among the municipal officers. The publication of the Commission's findings created a public scandal and led to the election of a reform administration. Croker, who had been obliged to resign in 1894, returned to the leadership of Tammany in 1897, and from that year until 1901 the Society enjoyed a period of almost unlimited political power over the city. In the latter year the Tammany Democrats were defeated by the reform candidate of the Fusion Party, Seth Low (q.v.), but they returned to power two years later. Charles F. Murphy (q.v.), who had succeeded Croker as the leader of Tammany in 1902, retained that position longer than any of his predecessors, serving until his death in 1924. During that period Tammany continued to exercise a profound influence in the political life of both New York City and State, although on several occasions Tammany-supported candidates were defeated.

Tammany achieved its greatest victory within the Democratic Party in 1928, when Alfred E. Smith (q.v.), a Tammany leader and former governor of New York, was nominated as the Democratic candidate for the Presidency. Smith was defeated, however, by the Republican candidate Herbert Hoover (q.v.). In 1929 the Tammany candidate James J. Walker (q.v.) was elected Mayor of New York. Charges of corruption were levelled at his administration, and the findings of an investigation conducted by Samuel Seabury (q.v.) at the instance of the State legislature were such as to cause Walker's resignation. In 1933 the Fusion candidate Fiorello La Guardia (q.v.) was elected to the mayoralty, inaugurating the longest period of political eclipse in the history of Tammany. The Society regained some of its influence within the municipal administration after the election of William O'Dwyer (1890- ) as mayor in 1945, but was unable to reassert itself as the dominant factor in the city's political life.

**TAMMERFORS.** See **TAMPERE.**

**TAMMUZ**, in Babylonian mythology, the counterpart of the Phœnician god Adonis, in memory of whom a feast was held yearly. The fourth month in the Babylonian calendar took his name.

**TAM O' SHANTER**, one of the best-known poems of the Scotch poet Robert Burns, based on the popular belief that no evil spirit can pass the middle of a running stream. The hero is pursued by witches for disturbing their dance at Alloway Kirk, and succeeds in crossing the river Doon in safety.

**TAMPA**, port of entry and county seat of Hillsborough Co., Fla., situated at the head of Tampa Bay and the mouth of the Hillsborough R., 330 miles S.E. of Pensacola. Transportation facilities include two railroads, for which Tampa is the Gulf terminus, more than thirty-five steamship lines, and municipal and county airports with service by major air lines. Tampa is the third-largest city in population in the State, one of the chief ports of the U.S., and the manufacturing center of the State. In a recent year, over 6,500,000 tons of shipping were handled at the harbor of Tampa, which is connected with the Gulf of Mexico by a ship channel 30 ft. in depth. The principal export of the port is phosphate rock; other exports are scrap metals, lumber, and canned citrus fruits. Steamship lines serving Tampa operate to both American and foreign ports, and the port is a gateway to Central and South America. The city is the leading U.S. center for the manufacture of clear Havana cigars. In addition, Tampa is noted for the canning of citrus fruits, especially grapefruit. Shipbuilding and the manufacture of tin cans, cigar boxes, packing crates, fertilizers, and cement are also important industries in the city.

Tampa is also a popular tourist center and winter resort, with a municipally maintained Tourist Recreation Center. The waters of the bay are noted for tarpon fishing; other recreational facilities include a municipal fishing pier, a yacht basin, and municipal golf courses, tennis courts, and swimming pools. The city is the winter headquarters of the Cincinnati Redlegs, a major-league baseball team, and site of the Gasparilla Carnival and Florida State Fair, held annually in February. Among the educational and cultural institutions are the University of Tampa, established in 1931, the Tampa Municipal Museum, the Tampa Art Institute, and the Tampa Bay Museum.

The site of the present city was first visited by the Spanish soldier, Pánfilo de Nárvaez in 1528, and in 1539 it was the starting point for the Spanish explorer, Hernando de Soto, on his journey to the Mississippi R. In later years the harbor was a refuge for pirate ships, including that of José Gasparilla. Fort Brooke was built on the site in 1823 by the U.S. Army and in the same year the first settlement was established. Tampa was captured by Federal forces during the Civil War. It served as the point of embarkation to Cuba for U.S. troops in the Spanish-American War. The industrial development of the city dates from the years between 1880 and 1890, when the first cigar factories were established there and the first railroad was built. Tampa became an important port after the opening of the Panama Canal in 1914. Pop. (1950) 124,681.

**TAMPA BAY**, an inlet of the Gulf of Mexico on the west coast of Florida. The bay proper is about 20 miles long, and has an average width of about 7 miles, the northern part being divided into Old Tampa Bay (about 12 miles long and 6 miles wide) and Hillsboro Bay (7½ miles long and about 4 miles wide). Its entrance is protected by a line of keys, or low islands, and it forms an excellent harbor.

**TAMPERE**, formerly **TAMMERFORS**, a city of Finland, situated on the rapids which connect lakes Näsi-järvi and Pyhä-järvi, 12½ miles N.W. of Helsinki by rail. Tampere is the principal manufacturing city of Finland, its leading products are textiles, paper, lumber, leather products, and refined metals. The city was founded in 1779, and its industrial importance dates from the beginning of the 19th century. Pop. (1950) 103,043.

**TAMPICO**, a city and seaport of the State of Tamaulipas, Mexico, situated on the N. bank of the Pánuco R., about 6 m. from its mouth on the Gulf of Mexico. The city lies in a rich oil-producing region, and is the chief commercial center of N.E. Mexico and one of the two most important seaports of the country. Transportation facilities include three railroads, ocean and river steamers, and air-line service. Vessels drawing up to 33 ft. may enter the harbor, which is equipped with extensive wharves, sheds, warehouses, oil-storage tanks, pipe lines, and equipment for loading oil tankers. A canal connects the port with the productive oil fields at Tuxpam, about 75 miles S. of the city. Other leading exports of the port are copper ores, silver bullion, lumber, wool, hemp, hides, cattle,



Lwing Galloway

*View of the downtown section of Tampa Florida from the harbor*

honey sugar coffee sarsaparilla and cotton seed cake. Among the industrial establishments in the city and vicinity are extensive oil refineries sawmills fruit processing and canning plants an electric light and power plant plants manufacturing and repairing oil well machinery and equipment and factories manufacturing clothing and ice. Tampa is a cosmopolitan city and has many tall business buildings. Several nearby resorts provide abundant facilities for bathing hunting, and fishing. Pop. (1951) 97,671.

**TAM-TAM** (Hind. 'drum' onomatopoeic in origin) an Indian or Chinese musical instrument. It consists of a metal disk concave in the middle and suspended by a loop. The tone is produced by striking the disk with a stick having a soft knob made of felt or leather.

**TAMWORTH**, a town of English County, New South Wales situated at the confluence of the Cockburn and Peel rivers about 285 m by rail N of Sydney. The town is a railway junction and the commercial center of a farming and livestock raising region. Diamonds are mined in the vicinity. Among manufacturing establishments in Tamworth are shoe factories, flour mills, breweries, saw mills, and plants engaged in the production

of galvanized iron and malt products. Pop. (1947) 17,071.

**TANA**, a river of British East Africa running SSE from Mt. Kenia to the Indian Ocean. Length 500 m.

**TANA**, a river of Norway. It forms part of the northern boundary between Norway and Finland. Length 100 m.

**TANAGER**, the popular name for the Tanagridae, a family of birds having a conical beak triangular at the base, the upper mandible notched toward the tip and its ridge arched. The best known of the three North American forms is the scarlet tanager, *Tanagra erythromelas*, also known as the fire bird, the most brilliant bird of the northern United States—the male bright scarlet with black wings and tail, the female light olive-green above, greenish yellow beneath. The immature males are like the females, but have the black wings and tail, and the adult male assumes this plumage in winter. The scarlet tanager has a pleasing song. From New Jersey southward there is found from April to September the summer tanager or summer redbird, *P. rubra*, rose red, brighter below, the wings tawny margined with rose. The female is olive green above, buffy yellowish green below. From the eastern

foothills of the Rockies to the Pacific there is found in summer the Louisiana or Western tanager, *P. ludoviciana*. The male is bright yellow, with the whole head crimson or scarlet, and the back, wings, and tail black. The female is exactly like the female scarlet tanager, except for white or yellowish markings on the wings.

**TANAGRA**, an ancient Greek city on the river Asopus in the extreme E of Boeotia, near the border of Attica. During the Hellenistic and Roman periods it was a flourishing agricultural community, said to produce the best wine in Boeotia. The town is famous chiefly for its extensive necropolis first opened in 1874, the tombs of which have yielded numerous graceful and charming terra cotta statuettes known as Tanagra figurines (see FIGURINE). The high value attached to these little figures has led to many modern forgeries, and it is often difficult even for an expert to detect the imitations.

**TANAKA**, BARON GIICHI (1863-1929) Japanese statesman and former army officer born in Yamaguchi. From 1910 to 1915 he was director of the Military Affairs Bureau and in 1913 he was dispatched abroad. He was given the rank of lieutenant general and vice chief of the general staff of the Japanese army in 1915. In 1920 he was created a baron and made a general in the army from which he retired in 1926. In 1925 he became leader

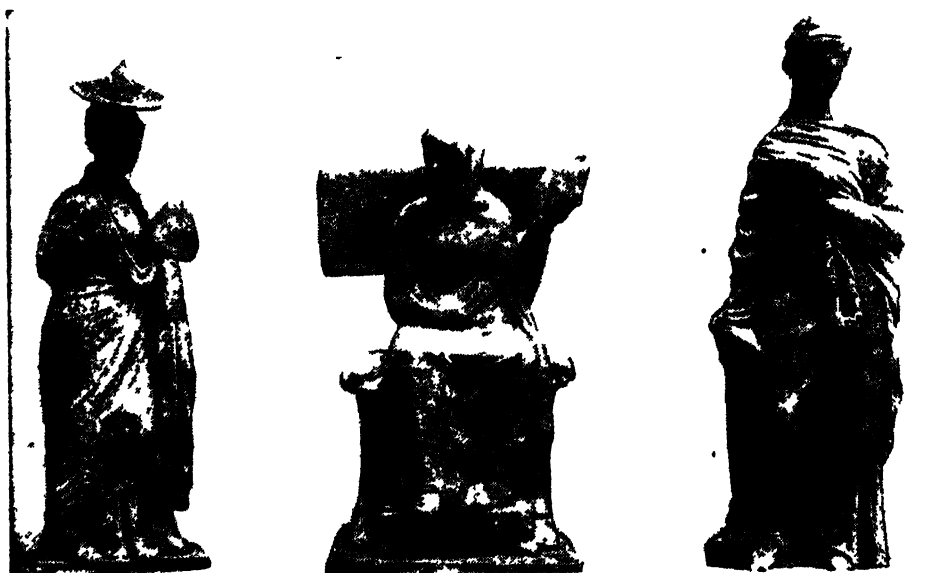
of the Seiyukai Party, and was prime minister and foreign minister, 1927-29. In this capacity, he became notorious as author of the *Tanaka Memorial* (1927), Japan's blueprint for conquest, outlining plans for control of a "Greater East Asia."

**TANANARIVE**, or **ANTANANARIVO**, capital of Madagascar. It is situated 4000 ft above sea level, 90 m from the E coast, to which runs a railroad to the port of Tamatave. Pop. (1950) 174,153.

**TANANA RIVER**, the longest of the affluents of the Yukon River. It rises in the S of Circle I and District Alaska and flows in a NW direction through the valley on the SW of the Ketchumstock Hills and after a navigable course of 310 m enters the Yukon at St. James.

**TANAUAN**, a town of Batangas Province, Luzon, Philippine Islands, 3½ miles SSE of Manila in a district where rice, Indian corn, fruit and sugar are produced in considerable quantities and livestock raised. Pop. about 15,000.

**TANCRED** (1078-1111) one of the chief of the first crusade, a son of the pilgrim Otho the Good and a minor sister of Robert Guiscard. He joined his cousin Bohemund at Tarentum. Guiscard's son in the first crusade and specially distinguished himself in the sieges of Nicusa, Antioch and Jerusalem.

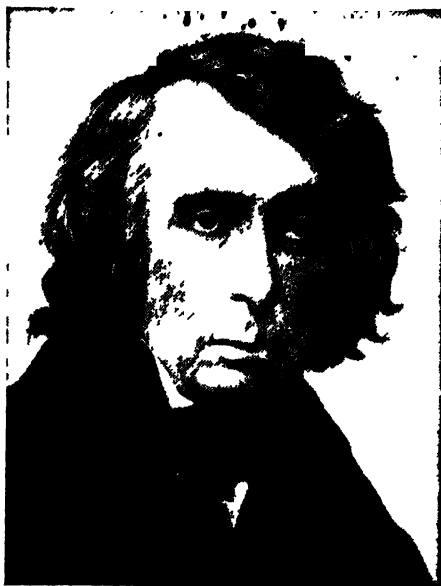


Metropolitan Museum of Art

*Terra cotta statuettes from Tanagra, dating from the 4th century B C*

**TANDY, JAMES NAPIER** (1740-1803), Irish agitator, born in Dublin. During the American Revolution he took an active part in the effort to prevent the use of English goods in Ireland; was an enthusiast in the "volunteer movement"; and was one of the foremost in the volunteer convention of November, 1783. Ten years afterward when he was about to be tried for writing a seditious pamphlet called *Common Sense*, he fled to the United States. In 1798 he went to Paris and was put in command of a vessel for an invasion of Ireland. He remained on Irish soil, however, but eight hours, and then went to Bergen, Norway, and from there by land to Hamburg. At the latter place he was seized and was delivered to the English and condemned to death, but through influence was released. He went to France and was made a general. He was the hero of the famous ballad, "The Wearing of the Green."

**TANEY, ROGER BROOKS** (1777-1864), American jurist, born in Calvert Co., Md., and educated at Dickinson College. He was admitted to the Maryland bar in 1799 and in the same year was elected a Federalist member of the Maryland House of Delegates. As a Federalist he was opposed to the policy of President James Madison, which led to the War of 1812, but after the outbreak of the war, he was a loyal supporter of the American cause; he later became a Democrat. From 1815 to 1827 Taney, then a leading attorney of the Maryland bar, made many appearances before the Supreme Court of the United States. He was elected to the Maryland senate in 1816, and from 1827 to 1831 he was attorney general of the State. In the first administration of Andrew Jackson, Taney was U.S. attorney general from 1831 to 1833. In 1832 he drafted that part of the President's celebrated message of 1832, made in connection with Jackson's veto of renewal by Congress of the charter of the Bank of the United States, in which the President enunciated his theory of the relations of the Presidency to the other branches of the Federal government. Taney and Jackson held that the executive, legislative, and judicial branches of the government were co-ordinate and equal, that each had an equal responsibility for determining the constitutionality of legislation, and that in such determinations the President was not bound by the findings of the U.S. Supreme Court; see **PRESIDENT OF THE UNITED STATES**; **SUPREME COURT, UNITED STATES**; **BANK AND BANKING**; *United States Banking System*; **JACKSON, ANDREW**.



*Roger Brooke Taney*

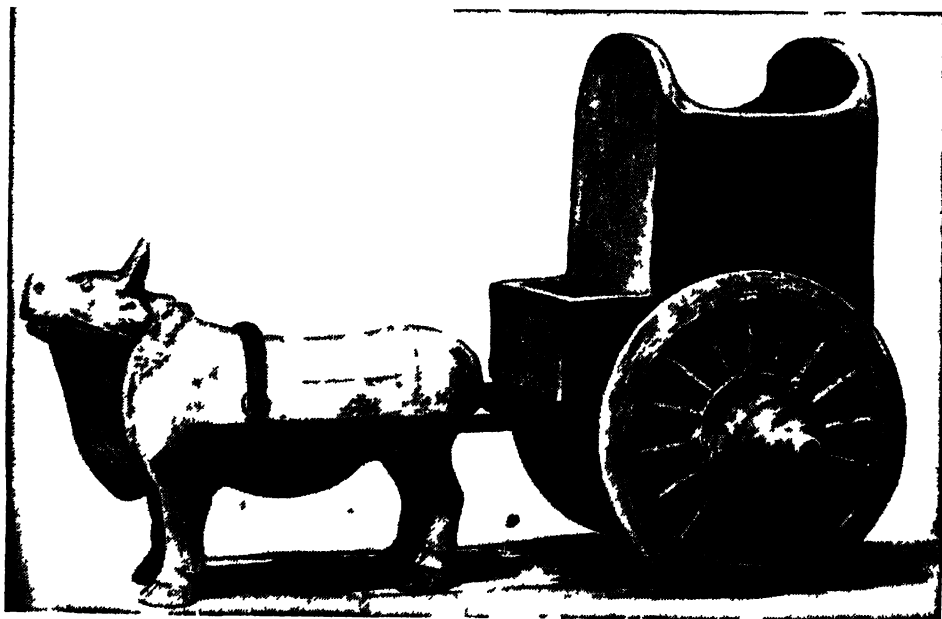
Because of its opposition to Jackson's policies, the Senate refused to approve his appointment of Taney as secretary of the treasury in 1834 and as an associate justice of the Supreme Court in 1835. However, following a change in the political composition of the Senate, Taney was approved as chief justice of the Supreme Court in 1836. He served in that capacity until his death. His tenure of office was marked by a number of notable decisions, the most celebrated of which was the decision rendered in 1857 in the Dred Scott case (q v). In that decision, written by Taney, the Supreme Court declared unconstitutional the Missouri Compromise (q v) enacted by Congress in 1820. The court's right to invalidate statutes as unconstitutional had been asserted by Chief Justice John Marshall (q v) in 1803. It had been applied, however, for the first time in 1842, when Taney was chief justice, to abolish a Pennsylvania statute; in the Dred Scott case, the court applied that power for the first time to invalidate a Federal law. Marshall and Taney are therefore regarded as the creators of the pivotal judicial power of the U.S. system of government and constitutional law. By some legal historians Taney is regarded as the greatest chief justice of the Supreme Court.

**T'ANG**, one of the seven most celebrated dynasties of China. It lasted from 618 to 907



MUSEUM OF ART

ART OF THE T'ANG DYNASTY Left Painting showing Bodhiatta in adoration Above A figure of Kuan Yin and Below Pottery tomb figure a clay bullock and cart



and was founded by Li Yuan, a soldier and a descendant of one of the princely houses. After a reign of eight years, during which many reforms were introduced, Li Yuan abdicated in favor of his second son, Li Shih-min (reigned 627-649), the real unifier of the empire and the most illustrious of the T'ang rulers. With the twelfth emperor decay began to set in and in 907 the line came to an end. In 923 a descendant of one of the T'ang emperors established the Posterior T'ang, which came to an end in 936 under its fourth emperor.

The T'ang is undoubtedly one of the most brilliant periods of Chinese history. The empire was extended to the Caspian Sea and China itself was divided into fifteen provinces. In 628 a maternal uncle of Mohammed visited China and built the mosque at Canton, and a century and a half later four thousand Mohammedan soldiers settled in the country. Learning and literature were fostered, and Buddhism, Taoism, and even Nestorian Christianity flourished under imperial patronage. Paper money was first used during the T'ang dynasty, and the *Peking Gazette* was founded.

**TANGA**, the administrative center and a seaport of the province of the same name, Tanganyika Territory, British East Africa, situated opposite Pemba Island on the s. shore of Tanga Bay. The town possesses a large harbor, which is navigable by ocean-going vessels, and is the terminus of a railway to points in the interior. A vehicular highway provides connections with Mombasa. Shipping is the chief industry of the town, normally the outlet for about one third of the exports of the Territory. Pop., about 13,000.

**TANGANYIKA**, a lake of Eastern Central Africa, lying between 3° and 9° S. lat., long. of center being 30° E.; length, 420 m.; its greatest breadth is about 45 m. Estimated area, nearly 13,000 sq. m. It was discovered by Speke and Burton in 1858. The only outlet is the Lukuga, which, flowing out on the w. side at 6° S., joins the Congo. From Kigoma on the E. shore of the lake, there is a steamer service to Albertville on the w. (Belgian Congo) shore. Stanley found Livingstone in 1871 at Ujiji on the lake shore 4 miles s. of Kigoma.

**TANGANYIKA TERRITORY**, a trust territory in East Africa, administered since Dec. 13, 1946, by Great Britain under a trusteeship agreement with the United Nations. It is bounded on the n. by Uganda and Kenya,

on the e. by the Indian Ocean, on the s. by Portuguese East Africa, Nyasaland, and Northern Rhodesia, and on the w. by the Belgian Congo and Ruanda-Urundi. The capital, largest city, and chief port of the territory is Dar es Salaam (q.v.). Tanganyika has a coastline on the Indian Ocean of about 450 m. The surface is generally flat and low along the coast, rising to a wide plateau in the interior from which climb high, isolated mountain groups, particularly on the w. border. The plateau is broken by the cleft of the Rift Valley and in the n. by a number of smaller clefts. Mt. Kilimanjaro (19,319 ft.), an isolated volcanic peak near the n. border, is the highest mountain in Africa. Lake Tanganyika forms part of the w. boundary, Lake Victoria Nyanza, part of the n. boundary, and Lake Nyasa, part of the s. boundary.

The extensive forests of the territory yield camphor and mahogany and other hardwoods. Timber production amounted, in a recent year, to approximately 3,000,000 cu. ft. Agriculture is the principal occupation of the people, the chief crops are cotton, coffee, sesame, millet, rice, tobacco, and sisal. Tanganyika is the world's leading producer of sisal. Livestock raising is important, and herds include 6,113,000 cattle. The territory is rich in minerals, notably diamonds, gold, and mica. The Tanganyika natives are chiefly of Bantu origin, and the Bantu and Swahili languages are widely spoken. Indians form a large minority group. Separate schools are maintained for natives (operated by the government), Europeans, and Indians (aided by government grants). Most of the natives are pagans, and the majority of Christianized natives are Roman Catholics. Communications include 21,371 m. of road, available to light motor traffic during the dry season, and 1600 m. of meter-gauge railway. Area, about 362,000 sq. m.; pop. (1948) 7,410,269 natives, 60,737 Asiatics, and 16,299 Europeans.

German colonization of the territory was begun in 1884 and by agreement with Great Britain the boundaries of the region, known as German East Africa, were fixed in 1886. The dominions of Zanzibar (q.v.) on the African mainland were absorbed in 1891, and the territory remained a German colony until World War I. It was invaded in 1914 by British and South African troops, and in 1920, under a league of Nations mandate, divided between Great Britain and Belgium, the latter country acquiring Ruanda-Urundi (q.v.). The League of Nations mandate was



British Information Service

TANGANYIKA TERRITORY Above: Native with fired tile which were made in the kiln in the background. Left: A typical native of Tanganyika in the town of Arusha.



length of the side of the triangle opposite the angle by the length of the side adjacent to the angle. The tangent varies in numerical value from zero to infinity for angles between  $0^\circ$  and  $90^\circ$ . The cotangent (usually abbreviated to *cot*) is the reciprocal of the tangent, i.e.,  $\cot = \frac{1}{\tan}$ .

**TANGIER**, or **TANGIERS** (Arab *Tanja*) a seaport of Morocco on a small bay or inlet of the Straits of Gibraltar. Together with a surrounding zone of about 140 sq m it is internationalized territory dissociated from the neighboring French and Spanish Morocco. Tangier was taken by the Portuguese in 1471 and given to Charles II of England as dowry with Catharine of Braganza but abandoned to the Moors by the English in 1684, when it became a pirate haunt. It was temporarily internationalized in 1911-12. A protocol signed by Great Britain, France, and Spain in 1925 provided for permanent security. But in 1929 Spain was given police control, and an international legislative body to exercise ruling power was established. Spain had full control from 1940 to 1945, when international control was resumed. Pop. (1949 est.) 150,000.

replaced by a United Nations trusteeship in 1946.

**TANGENT**, one of the fundamental trigonometric ratios. In a right triangle, i.e., a triangle having one right angle, the value of the tangent (usually abbreviated to *tan*) of an acute angle is given by dividing the



**TANGUY**, Yves (1900- ), American painter, born in Paris, France, and self-trained. After the end of World War I he served for some time as an officer in the French merchant marine and subsequently returned to Paris, where, in 1926, he became a member of the surrealist group; see **SURREALISM**. Tanguy's paintings of bones and amocbalike shapes, arranged in deserts and flat, lifeless places, quickly brought him recognition. He moved to the United States in 1939 and later became an American citizen. A typical example of his early work is "Mama, Papa is Wounded!" (1927, Museum of Modern Art, New York City).

**TANIS**, a city of ancient Egypt, situated in the N.E. portion of the Nile R. delta, 15 miles S.W. of Lake Menzaleh. The ancient city is now in ruins, and its site is partially occupied by the modern fishing village of San. Until the founding of Alexandria, in 332 B.C., Tanis was one of the chief commercial cities of Egypt, but the silting up of the Tanitic mouth (named for Tanis) of the Nile diverted trade to the new city. After a rebellion against Rome in 174 A.D., the city was destroyed in punishment, and it gradually fell into ruins. Tanis was for a time the capital of the Hyksos kings of Egypt and of the XIXth dynasty, and was the birthplace of the rulers of the XXIst and XXIIIrd dynasties, called Tanite (see **EGYPT: History**). Extensive excavations have uncovered temples, statues, and obelisks of Egyptological value. Tanis is identified as the Biblical city of Zoan (Numbers 13:22).

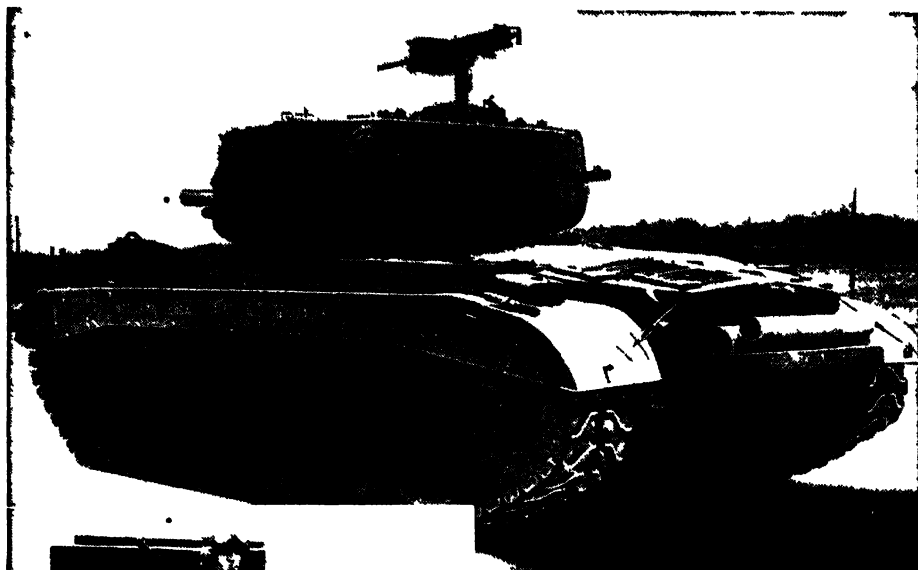
**TANISTRY**, an ancient form of tenure once prevalent among the Celts of Ireland. Under it lands were hereditary in families, but the members of each elected one of their number to be actual tenant.

**TANJONG PRIOK**, the seaport of Batavia, West Java, situated on the Bay of Batavia, about 6 m. by rail E. of the city. The port, one of the busiest and best equipped in the Republic of Indonesia, possesses a commodious artificial harbor. Two breakwaters, which are separated by a channel about 500 ft. wide, form an outer anchorage with a minimum low-water depth of 30 ft. The inner harbor, consisting of three sections totaling over 600,000 sq. yds. in area, provides berthage for vessels drawing up to 40 ft. of water. Port facilities include two dry docks, numerous piers and warehouses, and the canalized Chiliwong R., connecting the port with Batavia. Most of the import and export trade of West Java passes through Tanjong

Priok. In an average year more than 6000 vessels of all types enter the port. Pop., about 8000.

**TANJORE**, a city of Madras Province, Union of India, situated on the S. bank of the Cauvery R., about 218 m. by rail S. of Madras. The city lies in one of the richest agricultural regions of India. Noteworthy points of interest in Tanjore include an 11th-century temple, generally regarded as one of the finest examples of the pagoda style of architecture in existence. Among its outstanding features are the gopura, a pyramidal tower 200 ft. in height, and the beautifully embellished shrine of Subrahmanya. Another striking edifice is the palace of the former rajas. An old fort surrounds the palace, which was built in 1550. Tanjore is noted for the manufacture of jewelry, inlaid copperware, silk brocades, and carpets. Originally the capital of a Hindu principality, Tanjore was captured in 1674 by the Marathas (q.v.). The British secured possession of most of the principality in 1799, but the city and some adjacent territory were left under the rule of the native prince. After 1853, when the ruling family became extinct, the remnants of the principality passed under British control. Tanjore was the administrative center of the British district of the same name from 1855 until the partition (1947) of India. Pop., about 69,000.

**TANK**, an armored vehicle on caterpillar tracks, designed to operate off roads under conditions impossible to wheeled vehicles. The modern armored military tank was a British invention first used during the battle of the Somme near Amiens, Sept. 15, 1916. Today, tanks (classified as heavy, medium, and light) are employed as first-line offensive weapons to drive or widen wedges in enemy positions, to destroy wire entanglements without preliminary bombardment, and, almost completely replacing cavalry, for reconnaissance, raiding, and pursuit. They are designed for great mobility, maneuverability, and speed across rough country; amphibian tanks are built to cross rivers, etc. Means of defense against tanks include: tank traps, antitank mines, certain artillery weapons, and certain types of aircraft, as well as gun motor carriages (pieces of mobile artillery provided by mounting guns and machine guns on a medium tank chassis). Of the latter, the (American) M-7 and M-10 (widely credited for their role in the defeat of the Germans in the African campaign of 1942-43), are particularly referred to as "tank killers". A dis-



U S Army Ph togr 1he

U S ARMY TANKS Above Side view of  
a heavy tank which is equipped with  
a 105 mm howitzer Left Look out  
and gunner on a heavy tank Below  
Driving a tank aboard a train port





S. A. Hard Oil Co. (N. J.)

*A tanker anchored at a port on the eastern coast of the United States*

tinguishing characteristic of the M 7 is its MG ring mount resembling a pulpit (officially referred to as pivot).

**TANKAGE**, a name applied to a product used mainly for fertilizing purposes which is prepared from the residue resulting from the treatment of abattoir and slaughterhouse refuse with steam and hot water in closed tanks for the removal of fat; this process is commonly known as tanking. Tankage is variable in composition depending upon the materials used in its preparation and the process of manufacture but is generally rich in nitrogen and it is this element which mainly determines its value as a fertilizer.

**TANKERS**, types of freight-carrying ships the holds of which are built for the carrying of oil or other liquid.

**TANNAHILL, ROBERT** (1774-1810) Scottish poet, born in Paisley. He was apprenticed to his father, a silk weaver, and passed most of his life in Paisley at the loom. As a song-writer Tannahill possessed a spontaneity akin to that of Robert Burns. Among his best songs are "Bonnie Wood o' Craigie", "Sleepin' Maggie", "Braes o' Gleniffer", "Gloomy Winter's noo awa'" and "Jessie the Flower o' Dunblane". Suffering from melancholia, Tannahill drowned himself in a canal near Paisley.

**TANNENBERG**, a village formerly belonging to East Prussia and since 1945 to

Poland situated about 75 miles s.w. of Kaliningrad (formerly Königsberg). Tannenberg is famous as the site of two great battles. On July 15, 1410 the Poles and Lithuanians inflicted a decisive defeat on the Teutonic Knights (qv) marking the beginning of the decline of that order. In modern history, during World War I Tannenberg was on Aug. 6-8, 1914 the scene of a great German victory over the Russian army. The German forces were commanded by General Paul von Hindenburg who had been recalled out of retirement and who as a result of his leadership in this battle was made commander in chief of the German armies in the East. The battle of Tannenberg was fought through several neighboring villages including Allenstein, Soldau, Ortelsburg, Mühlen and Hohenstein. The Germans held the center of their line near Tannenberg and turned both flanks of the Russian army. Though outnumbered by the Russians 250,000 to 135,000, they inflicted such a severe defeat that the Russian offensive against Königsberg was broken.

**TANNER, BENJAMIN T. J. K. R.** (1835-1923), American Methodist Episcopal bishop, born in Pittsburgh, Pa. and educated at Avery College, Allegheny and at the Western Theological Seminary. After being ordained into the American Methodist Episcopal ministry he held pastorates in various churches and in 1888 was made bishop. He

was editor of the *Christian Recorder* (1867-83), and of the *African M. E. Quarterly Review* (1884-88). Among his publications are *The Origin of the Negro; Is the Negro Cursed?* (1869) and *The Color of Solomon—What?* (1901).

**TANNER, HENRY OSSAWA** (1859-1937), American Negro artist, son of Bishop Benjamin Tucker Tanner, born in Pittsburgh, Pa. He studied art under Thomas Eakins in Philadelphia, and under Laurens and Constant in Paris. He first exhibited at the Salon in 1895. His paintings are largely of Biblical subjects and include "Daniel in the Lions' Den" (1896); "The Raising of Lazarus" (1897), purchased by the French government for the permanent collection of the Luxembourg; "The Coming to Christ"; "The Jews' Wailing Place"; and "Christ in the Temple". He was awarded many prizes and medals, and was elected a member of the National Academy in 1927.

**TANNHÄUSER**, opera in three acts, with music and text by the German composer Richard Wagner. It was first presented at Dresden, Germany, on October 19, 1845; its first American performance was given in New York City on April 4, 1850. The scene of the opera is 13th-century Germany.

Act One opens on the Venusberg in Thuringia, where Tannhäuser, the Knight of Song, yearns for earth despite the lures of Venus, who has surrounded him with love and beauty in her magic grotto. She is unwilling to let him go, repeatedly forces him to sing her praises, and, when he continues to beg for release, tells him he will be scorned on earth and despised in the Christian world. Tannhäuser replies that he places his faith in the Virgin Mary; at her sacred name the grotto and its pagan inhabitants disappear and Tannhäuser finds himself in the valley of Wartburg. A band of pilgrims on their way to Rome pass by, and Tannhäuser kneels in prayer as they leave the scene. He is then recognized by his loyal friend Wolfram, who enters with the Landgrave and his nobles on a hunting expedition. Tannhäuser evades their questions concerning his long absence. Wolfram tells him that the Landgrave's niece Elizabeth still sorrows for him. Tannhäuser consents to return with them, and to enter the coming contest at Wartburg.

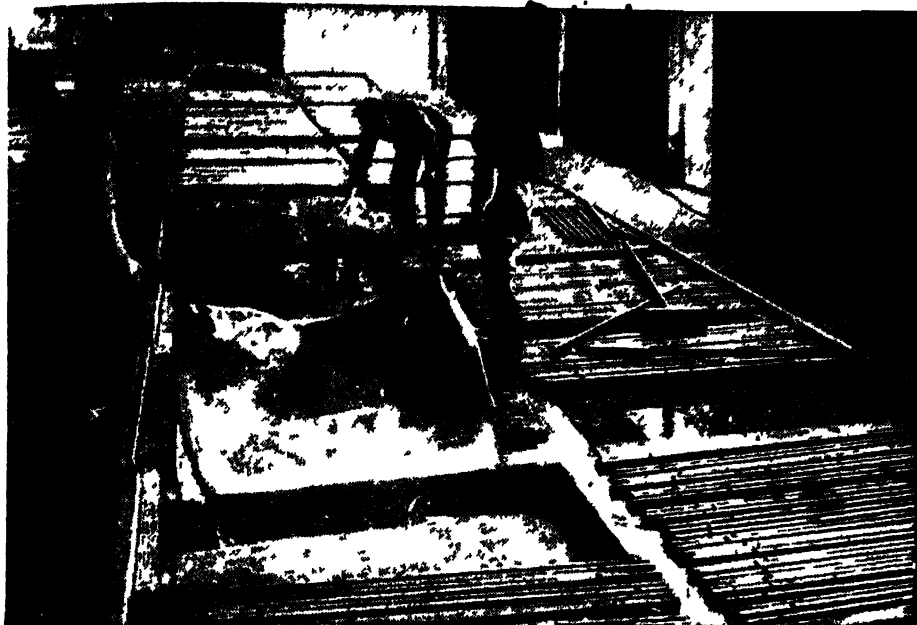
Act Two takes place at Wartburg Castle, where Elizabeth joyfully greets the errant knight. When all the minstrels have assembled, the contest begins. The theme is Love, and the Landgrave has offered Eliza-

beth's hand to the winner. Wolfram, who is in love with Elizabeth, sings of virtuous love, but Tannhäuser, bound by his promise to Venus, sings passionately of the sensual love aroused by the goddess. All the women but Elizabeth leave the hall, outraged at his unholy hymn, and the men rush at Tannhäuser with drawn swords. Elizabeth pleads for him, and he is allowed to join a passing band of pilgrims to beg forgiveness of the Pope.

Act Three finds Elizabeth praying at a wayside shrine, hoping to learn news of Tannhäuser from returning pilgrims. After months of waiting, Elizabeth dies brokenhearted, and the faithful Wolfram compares her pure spirit to the evening star. A tattered stranger now appears. It is Tannhäuser, to whom the Pope has said he could no more forgive than his barren staff could again break into leaf. Despairing of pardon, Tannhäuser is about to succumb again to the temptations of Venus, who now appears in a vision beckoning to him, when Wolfram speaks to him of Elizabeth. Tannhäuser is deeply penitent, and as Venus disappears mourners enter bearing Elizabeth's body. The grief-stricken Tannhäuser sinks down beside her, and praying to her as his saint, dies as the Pope's messengers arrive proclaiming a miracle: the staff has blossomed.

**TANNHÄUSER** (fl. 13th century), German knight and minnesinger, probably a Bavarian by birth, who enjoyed the favor of Duke Frederick II of Austria. His lyrics are in the main mocking and sensuous. One of the latest of them, a penitential song, may have led to his identification with the hero of the old Teutonic legend of the Venusberg or Hill of Venus. This was a region within a mountain near the Wartburg, in the Thuringian Forest, where Venus reigned, and whence no one save Tannhäuser ever escaped. Here Tannhäuser, in the legend, lived with her until conscience smote him. He escaped, with the aid of the Blessed Virgin, and set out on a pilgrimage to Rome, to obtain pardon for his grievous sin. According to the story, Pope Urban IV refused to pardon the sin until the staff in the Pope's hand should sprout. Tannhäuser returned to the Venusberg, but the wand meantime put forth green leaves by a miracle, to show the extent of the divine mercy. The most widely known version of the legend is the dramatic treatment by Richard Wagner in his opera *Tannhäuser* (1845).

**TANNIC ACID.** See **TANNINS**.



Farmers Council of America

*Pulling cowhides from tannin vat in a tanning factory*

#### **TANNING.** See **LEATHER**

**TANNINS, TANNIC ACID** or **GALLOTANNIC ACID**, common name applied to a group of amorphous or crystalline vegetable products obtained from various plants, and important commercially in the tanning of leather (qv). Common tannin, or digallic acid  $C_{12}H_{14}O_8$ , occurs abundantly in gallnuts (see **GALL**), sumach, and tea (qqv), and is obtained by extraction with a mixture of alcohol ether and water. Almost all tannin thus extracted dissolves in the water fraction. The tannin-water solution is then separated and purified by shaking, and evaporated at a low temperature. Alder tannin  $C_{12}H_{14}O_8$  is a reddish-brown substance moderately soluble in dilute alcohol and extremely soluble in hot water. It is prepared by extracting sawdust from various alder trees of the genus *Alnus*, especially *A. glutinosa*. Caffeotannic acid,  $C_{16}H_{18}O_{10}$ , is obtained from coffee berries and is found as a component of other vegetable compounds. It is prepared by extracting coffee berries with alcohol and evaporating the solution to dryness. The acid thus obtained is soluble in both water and alcohol. Other common varieties of tannin include oak tannin,  $C_{12}H_{14}O_8$ , a reddish powder found combined with gallic acid and quercite in the oak bark, and moringa tannin, or ma-

clurin  $C_{12}H_{14}O_8$ , found in species of the genus *Chlorophora*.

Tannins have a bitter astringent taste. All tannins are soluble in water and alcohol, insoluble in ether, chloroform and benzene, and partially soluble in alcohol-ether mixtures. When exposed excessively to light, they become yellowish to light brown in color. Upon hydrolysis they yield gallic acid (qv), pyrogallol and other related compounds. Solutions of tannin are precipitated by the addition of various salts and acids such as potassium sulfate and sulfuric acid.

Aside from their importance in the leather-tanning industry, tannins are used extensively in the manufacture of inks (qv), as mordants in dyeing, and in the clarification of wines. Medicinally, tannic acid is used in the treatment of ulcers, sores, and hemorrhoids.

#### **TANNU-TUYA.** See **TUYA AUTONOMOUS REGION**

**TANOAN STOCK**, a family of languages spoken in a group of pueblo villages in the upper Rio Grande Valley, New Mexico. In culture these villages are very much what they were when first visited by Spanish explorers some three hundred years ago. They are regarded as the most typical pueblo group and probably the oldest from which the others derived their culture.



Tansy

**TANSILLO, LUIGI** (1510-68) Italian poet of the Petrarchistic group born in Venosa, province of Potenza. He early entered court service and in 1535 joined the bodyguard, formed of one hundred nobles, of Don Pedro de Toledo, the Spanish viceroy of Naples, with whom and with whose son, Don Garcia, Tansillo subsequently stood in great favor. He accompanied them on their expedition against the Turks and fought with conspicuous bravery. Subsequently he was capitano di giustizia at Gaeta and died at Terno. His ingenious and sensuous poem *Il Vendemmia Jore* (1534) established his literary reputation, but caused his writings to be placed on the Index by Pope Paul IV. To atone for it, Tansillo resumed a religious epic *La Iagime di San Pietro*, begun in 1539, but left it unfinished. His two didactic poems *La Bala* and *Il Podere* are among the best in Italian literature. His lyrics, inspired by impassioned love for a high-born lady, are replete with

fervor and fine descriptions of nature. They were turned to philosophical meanings in the *Heroic Furies* of the later Italian writer Giordano Bruno, whence some were translated by the English writer John Addington Symonds. In the *Stanza a Don Pedro di Toledo* (1547) he depicts with consummate art the luxurious gardens of the viceroy by the sea.

**TANSY** (*Tanacetum*), a genus of plants of the natural group Compositae. It is now naturalized in many parts of North America. It is a perennial, from 2 to 4 ft. high. The deep green leaves and yellow flowers have a strong aromatic smell and a bitter taste.

**TANTA** or **TANTAH**, a town of Lower Egypt between the Rosetta and Damietta branches of the Nile, 76 miles S.E. of Alexandria. The town is the site of a famous mosque. Pop. (1947) 159,965.

**TANTALITE.** See COLUMBITE.

**TANTALUM**, a rare metallic element of atomic number 73, atomic weight 181.4, and symbol Ta, belonging to the group of metals which includes vanadium and columbium (qv). It occurs mainly in the mineral tantalite (see COLUMBITE),  $\text{FeTaO}$ , and was first obtained in 1820 by the Swedish chemist Jöns Jakob Berzelius, who heated potassium tantalofluoride,  $\text{K TaF}_6$ , with excess potassium. Principal deposits of tantalum occur in Australia and Scandinavia. In the United States small deposits of tantalum are found associated with the pegmatite veins of the Black Hills of South Dakota. Commercially, tantalum is prepared by the electrolysis of fused potassium tantalofluoride or of tantalum compounds dissolved in dilute sulfuric acid. Tantalum is a white, ductile, malleable metal having a melting point of 2850°C (5162°F), a boiling point of 5400°C (7742°F), and a specific gravity of 16.6. It is soluble in fused alkalis, insoluble in sulfuric, hydrochloric, and nitric acids (qv), and soluble in hydrofluoric acid. It ignites in air to form tantalum pentoxide,  $\text{Ta}_2\text{O}_5$ , a white infusible substance which combines with metallic oxides or hydroxides to form compounds called *tantalates*. Tantalic acid,  $\text{HTaO}_3$ , is a gelatinous precipitate made by adding water to tantalum pentachloride. Because it is more resistant than platinum (qv) to many corrosive agents, tantalum has largely replaced platinum in standard weights and crucibles. It is used as an alloy with other metals, and until the introduction of tungsten, was the material commonly used for filaments in incandescent lamps.

**TANTALUS**, or WOOD IBIS, a genus of birds of the Stork family, Ciconiidae, quite distinct from the true ibises. The American wood ibis, *T. loculator*, is as large as a stork but more slender, white, with black quill and tail feathers, the naked skin of the head and neck black. It is especially at home in South America, but also breeds abundantly in Florida.

**TANTALUS**, in Greek mythology king of Sipylus, in Iydia the son of Zeus and the father of Pelops and Niobe (qqv). Tantalus was admitted to Olympus (qv) by Zeus but abused the friendship of the gods by a crime variously reported as serving the flesh of his son Pelops to the gods at a banquet, stealing the nectar and ambrosia of the gods, divulging their secrets, or denying knowledge of a golden dog stolen from the shrine of Zeus. His punishment in the underworld became proverbial. He was afflicted with an insatiable hunger and thirst and had to stand up to his chin in a lake the waters of which receded whenever he tried to drink of them, over his head hung a fruit which eluded his grasp whenever he endeavored to reach them. From this story has come the modern verb 'tantalize'.

**TANTRAS**, the sacred books of the Sikhs, sect of Hindus. Their acceptance as sacred literature marks the influence of demonology on Hinduism. The chief peculiarity of the tantris is the prominence they give to the female energy of the deity Sakti.

**TAOISM**, a system of philosophy (also a type of religion today) in China the greatest exponent and practical founder of which Lao tse is venerated by the educated Chinese second only to Confucius. Lao tse himself could present no adequate definition and simply calls it "the way." Broadly speaking Tao may be defined as the proper way, the right road, a conduct of life designed to give the greatest individual happiness, contentment, and peace of mind. J. M. Kennedy presents the following definition: "Tao is a word which it is almost impossible to define fully and accurately, refers to 'the way' in which things first came into being out of primordial nothingness and how without struggling or striving the phenomena of nature still continue."

**TAPAJOS**, a river of Brazil and an affluent of the Amazons, formed by the confluence of the Arinos and the Juruena both of which rise in the s of Matto Grosso State. After a northward course of 1100 m the Tapajos falls into the Amazon at Santarem.

**TAPE GRASS**, or EELGRASS, common name applied to a fresh-water plant, *Vallisneria spiralis*, belonging to the Frog's-Bit family, Hydrocharitaceae. The plant, which is found abundantly in standing waters throughout the world, is widely used in home and commercial aquariums. The inconspicuous white flowers are borne in solitary, tubular spathes and consist of a three-parted calyx, three petals, three stamens, and a solitary pistil. The fruit is cylindrical, elongated and berrylike. Tape grass has been planted in eastern portions of the United States as food for wild ducks, and is sometimes called 'wild celery'. The pistillate flowers borne on long coiled threads float on the surface of the water. When the staminate flowers which are borne on short stalks near the bottom of the plant, break off from their stalks they rise to the surface and float about thereby spreading the pollen to the pistils. The name 'eelgrass' is also applied in some instances to submerged marine plants called grass wracks (qv).

**TAPESTRY**, an ornamental textile used for the covering of walls and furniture and for curtains and hangings. In its method of manufacture it is intimately related to Oriental carpets which are made in precisely the same way. Fine picture tapestries are however much more elaborate and costly than any carpets and they have altogether different artistic pretensions.

Tapestries are divided into two classes depending on whether they are made in high warp (*haute lisse*) or low warp (*basse lisse*) looms. It is in high warp looms that the most elaborate pictorial tapestries are made, low warp looms being now largely devoted to the production of still life and non pictorial decorative compositions.

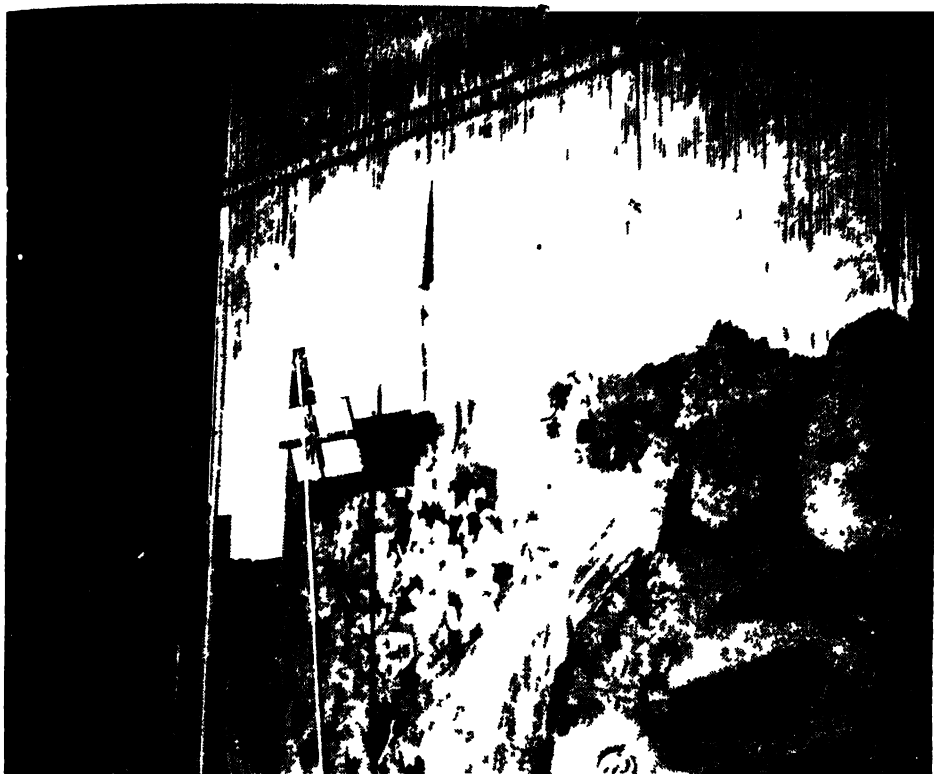
The art of tapestry working came to Europe from the East and was generally known as *Serrimen*. So far as is known the art of high warp tapestry weaving was first practiced in Flanders toward the end of the 12th century and it flourished in the rich and prosperous towns of Arras, Valenciennes, Lille and Brussels and from the predominant importance of the first of these towns, tapestries came to be generally known as "Arras". From the early part of the 17th century to the present day the Gobelin factory has continued to be the source of the most artistic of high warp tapestries and where produced. This family introduced the art into France in the previous century by engaging two Flemish workmen. The manu-



French Embassy, Information Division

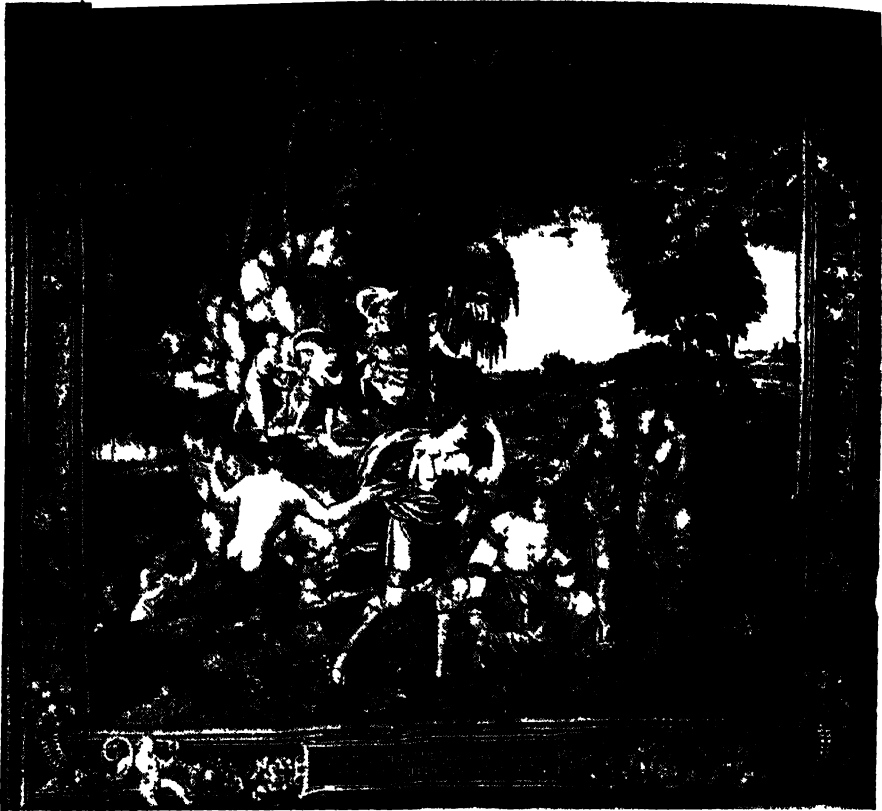
MAKING TAPESTRIES AT GOBELINS, FRANCE. *Top: Tapestry artist making tracing of design by Henri Matisse, to be copied on the loom. Bottom. After the design is indicated in black, a weaver chooses bobbins in various colors, following the design of the painter.*



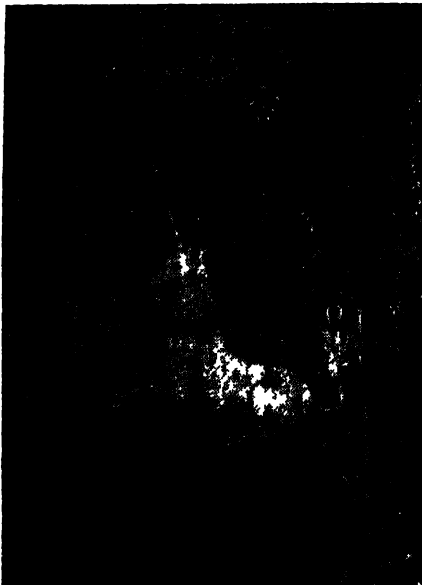


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**MAKING TAPESTRIES AT GOBBI INS, FRANCE** *Top* On a high warp tapestry weavers work behind a vertical loom. Their fingers can be seen through the threads in the center. *Bottom* Weavers work directly on a horizontal loom in producing low warp tapestry.



Art Inst of Chicago Metropolitan Mus of Art  
 TAPESTRIES Above Flemish tapestry of the  
 16th century Left 'The Unicorn in Captiv  
 ity' famous 16th century French tapestry



factures of the Savonnerie, an establishment founded by Henri IV for velvet pile carpets and hangings, was in 1826 combined with the Gobelins. The present commercial center is Aubusson.

It was as patterns for tapestry that Raphael produced the series of cartoons illustrating the acts of Christ and the Apostles which were executed in Brussels for the Sixtine Chapel. Seven of these cartoons, purchased by Charles I under the advice of Rubens, are now in South Kensington Museum, London. In 1893 Lousadier set up a small loom in New York and wove "the first piece of tapestry produced in America." Of special interest are the ancient Peruvian tapestries now in the National Museum at Washington and in the Boston Museum of Fine Arts.

See also BAYEUX TAPESTRY

**TAPEWORM**, common name applied to any of the cestode flatworms constituting the order Merozoa. Tapeworms are intestinal parasites of vertebrate animals. They are flattened worms ranging in length from about  $\frac{1}{2}$  inch to about 30 feet. The adult tapeworm is characterized by the presence of a head or *scolex* equipped with two or four pairs of suckers and often with a crown of hooklets for attachment to the intestinal lining of its host. At the rear end of the scolex is a narrow *neck*, from which body segments, or *proglottids*, are budded off asexually. Tapeworms may have as few as three or as many as several thousand proglottids. The proglottids contain organs of sexual reproduction, each with both testes and ovaries; the segments at the posterior end of the worm mature most rapidly and when ripe, are separated from the main body of the worm to pass out with the feces. The newly detached proglottids contain numerous eggs, each containing an embryonic tapeworm.

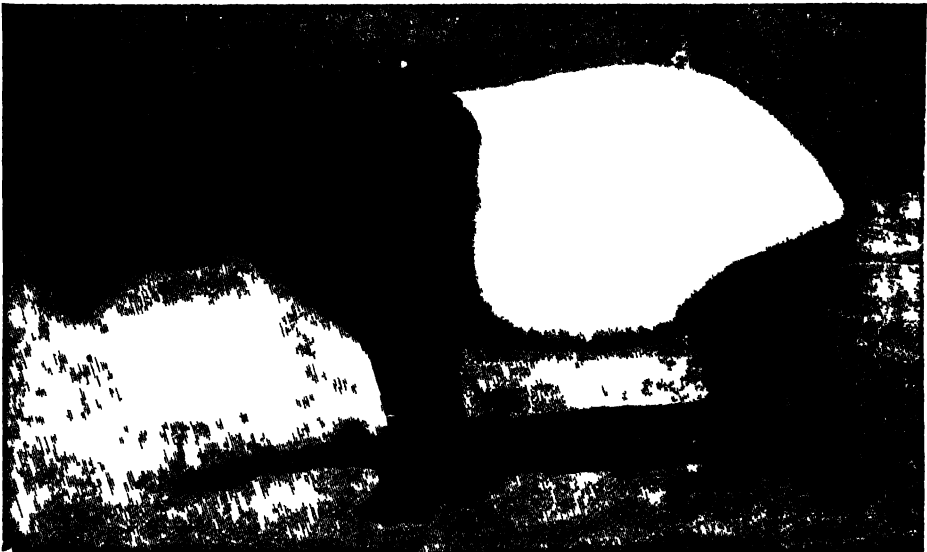
When the next segment ingested by another primary host, the proglottids regenerate a new scolex which attaches itself to the intestinal wall and the tapeworm resumes its growth by budding. When the eggs are ingested, they hatch in the intestinal tract, releasing larval forms which burrow into the tissues of the host and form cysts. These encysted forms are known by such names as *bladder worms*, *cysticerci*, *hydatids* and

*measles*; the host harboring this stage is known as an intermediate host, in contrast to the primary host, in which the tapeworm seeks the mentary canal and develops there. The larvae often exhibit specific selection of tissues in encysting, for example, *Taenia echinococcus* attacks the liver in man and dogs, and *T. coenurus* attacks the brain in sheep, causing the disease known as gid (qv). When larvae are ingested by a primary host usually encysted in the meat of the intermediate host they are stimulated by the gastric juice to develop into adult tapeworms. The adults attach themselves to the intestinal wall and absorb partially digested food through their body surface; tapeworms have no mouths or digestive canals.

Several vermifuges are used in the treatment of tapeworm infestation, unless the scolex is dislodged the worm is not eradicated. For the common tapeworms infesting man, see the table in the article PARASITE.

**TAPIOCA.** See CASSAVA.

**TAPIR** (*Tapirus*), a genus of Ungulata, of the section Perissodactyla, having a bulky form, with moderately long legs, the fore feet four toed the hind feet three toed. The tapir has thick skin, short hair, small tail, thick neck, short ears, small eyes, elongated muzzle, and the nose prolonged into a short flexible proboscis. There are five species of which four are American and one Oriental. The best known is the American tapir *T.*



*The Malayan tapir, found in Malacca and Sumatra*

*americanus*, which is about the size of a small ass, and is common in almost all parts of South America. Another species is found in the Andes, and two others in Central America. The tapir feeds chiefly on young shoots of trees, fruits, and other vegetable substances. The Malayan tapir, *T. indicus*, is found in Malacca and Sumatra. It is larger than the American tapir, and its proboscis is rather longer in proportion.

**TAPPAN, ARTHUR** (1786-1865), American merchant and philanthropist, born in Northampton, Mass. He entered business in Portland, Me., and Montreal, Canada. In company with his brother Lewis he set up a dry-goods importing business in New York (1814). He founded Oberlin College and the American tract society; he endowed Lane Seminary, Cincinnati, and a professorship in Auburn theological seminary. An ardent Abolitionist, he was first president of the New York City antislavery society, founded the New York *Emancipator* (1833), and rescued William Lloyd Garrison from imprisonment in Baltimore (1833). With his brother Lewis he founded the New York *Journal of Commerce* (1828).

**TAPPAN, LEWIS** (1788-1873), American merchant and reformer, brother of Arthur Tappan, born in Northampton, Mass. He entered the dry-goods business in Boston, being specially interested in calico-print and cotton works. In 1827 he united with his brother to found the firm of Arthur Tappan & Company, and next year the two founded the New York *Journal of Commerce*, of which he became sole owner the next year. He was prominently associated with the Abolitionist movement. He was founder of the American missionary association.

**TAPPAN BAY** or **TAPPAN ZEE**, an expansion of the Hudson River, in New York, lying immediately north of Irvington. It is about 11 miles long, and over 3 miles wide at the widest point.

**TAPUYAN**, a collective designation for a group of tribes holding an extensive area in eastern Brazil, constituting a distinct stock, and apparently more ancient in occupancy than any of the surrounding tribes. The Tapuyan tribes, among which the Botocudo are the most noted and typical, have every characteristic of an ancient primitive race. In physique they are of middle stature, with long arms and short legs, broad faces, small deep-set eyes, retreating foreheads, and projecting lower jaws. Their features are frequently

disfigured by labrets in the lower lip. Their culture is low.

The Tapuyas have no tribal organization, do not possess dogs, build no canoes, make no pottery. But they are skillful hunters with the bow and arrow, make polished stone axes, and weave baskets of rushes. The men of the Tapuyan tribes have but one wife at a time. See BOTOCUDO.

**TAR**, a term applied to the oily, dark-colored products obtained in the destructive distillation of peat, wood, coal, bones, and other materials of organic origin. Wood tar is commonly made from the roots and wood of various trees such as the beech and pine. In the old process wood was heaped into a conical stack depressed at the center, covered with earth, and fired. The tar condensed and ran to the center of the pile. The operation is now more economically conducted in retorts by distillation. See COAL TAR, WOOD DISTILLATION.

**TARA**, a hill (507 ft.) in County Meath, Ireland, 7 miles S.E. of Navan. Here prior to 560 is said to have stood the hall of the early kings of Ireland.

**TARAFÄ** (fl. about 560), early Arabian poet. He lived at the court of the king of Hira in northeastern Arabia. In consequence of his satires on royalty, the king had him put to death. Tarafa ranks as one of the six great pre-Islamic poets of Arabia, and is the author of one of the seven *Mu'allakāt*, or exalted poems, of that period, which remain the classic models of Arabic poetry.

**TARA FERN** (*Pteris aquilina*), a species of bracken, the rhizome of which was one of the principal articles of food of the Maoris before the settlement of New Zealand by British colonists.

**TARAI** or **TERAI**, a low, moist, forest belt stretching along the southern base of the Himalayas nearly throughout their length, from Assam in the east to the Punjab in the northwest. In spite of its unhealthy nature, it is densely populated by tribes who seem to be immune from malarial diseases.

**TARANAKI**, a provincial district of North Island, New Zealand, situated in the S.W. portion of the island and adjoining the Tasman Sea. The district is mountainous and heavily forested. Mount Egmont (Maori *Taranaki*), a volcanic peak, is the highest elevation (8260 ft.). Occasionally described as "the garden of New Zealand", the district is a highly productive agrarian region. Dairy farming is the principal industry and the chief crops include grain and fruit. Several

railway lines, which provide connections with all major points on North Island, traverse the district Area, 3750 sqm, pop (1951 est.) 8685.

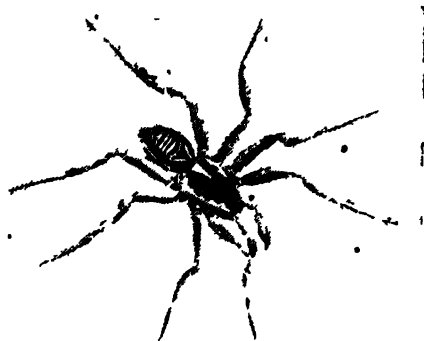
**TARANTELLA**, an Italian dance, written in 5 or 6/8 time, constantly increasing in speed and alternating between the major and minor modes. It is accompanied by castanets and a tambourine. During the Middle Ages the dancing of the tarantella was thought to cure a form of insanity induced by the bite of the largest of European spiders, the *Lycosa tarantula*. See TARANTISM.

**TARANTISM**, a choreic hysterical affection (see CHOREA) beginning in a state of lethargy and depression which was treated during the Middle Ages by excessive dancing. During the Middle Ages epidemics of dancing mania occurred throughout central and southern Europe, and the dance invented for the presumed purpose of curing the mania, the tarantella named after the southern Italian town of Taranto, gave the condition its name.

**TARANTO** (anc. *Tarentum*) a seaport of Italy in the province of Lecce on the Gulf of Taranto. The principal buildings are a modernized cathedral and a castle erected by Charles V. The Mare Piccolo is still famous for its shellfish and a considerable portion of the inhabitants find employment in oyster and mussel fisheries.

The ancient Tarentum founded by a body of Spartan emigrants about 705 BC grew to be the sovereign city of Magna Graecia. At the height of its greatness it provoked a quarrel with Rome (51) was saved for a little by Pyrrhus King of Epirus but was taken in 272 by Hannibal, it was retaken by the Romans in 207 BC. The Goths were left it in the hands of the Byzantine Empire. It was captured in 661 AD by the Lombards passed into the hands of the Saracens and of the Greeks from the latter of whom it was wrested by Robert Guiscard the Norman in 1063. Later it shared the fortunes of the Kingdom of Naples. During World War II, in an encounter between British and Italian naval units at Taranto Nov. 12, 1940 severe damage was inflicted on an anchored units of the Italian fleet. Pop. (1951) 174,171.

**TARANTULA**, a famous species, *Tarantula ferox*, of European wolf spiders (Lycosidae), whose bite is not dangerous. The name is generally applied in the United States to the so-called American tarantulas of the family Theraphosidae. These are large,



*European tarantula*

hairy spiders occurring in the southwestern United States, Central America and South America. They feed upon insects and all sorts of small animals. *Arane ferox* is a large species of the group having a bite which is painful but not dangerous and never fatal so that it is a useful record.

**TARANTULA KILLER**, common name for any variety of the genus *Psecus* common in the southwestern United States and in Central America which prey especially on tarantulas (qv). The common species is *P. Iorner* which is more than 2 inches long. The head, thorax and abdomen and long, spiny legs are black while the wings are bright reddish brown with black spots at the tips. It finds the spider inducing complete paralysis and deposits an egg upon it then buries it in a hole so the deep after the manner of other mud wasps (qv).

**TARAPACA**, a maritime province of Chile. The surroundings are extensive vast fields of nitrate of soda (in the district of Atacama) as well as silver mines deposits of guano and flocks. The capital is Iquique. Tarapaca was ceded to Chile by Peru in 1884. Area 11,400 sqm, pop. (1950 est.) 110,870.

**TARARE**, a manufacturing town in the department of Rhone, France, 20 miles NW of Lyons. In 1786 the manufacture of muslins for which it has since become famous, was introduced from Switzerland. The chief products of its mills are muslins, tulletrains, silks, silk plush and velvets. Pop. about 12,000.

**TARASCANS**, or TARASCO, a middle American distinct linguistic stock, who like the Aztecs seem to have migrated from the north. Their kingdom was in the province of Michoacan and their capital was Tzintzuntzan. Their civilization in some respects

excelled that of the Aztecs, and the ruins of their buildings, still largely unexplored, and their work in gold and silver testify to this. They surpassed all other native tribes in their defensive armor of wood covered with plates of copper or gold. In physique they were considered the tallest and handsomest people of Mexico. They number about 200,000, and they maintain their reputation for the weaving of beautiful rebozos and belts with figures of birds and animals, and for their lacquer work. Despite the fact that they offered no resistance to the Spanish invasion of Mexico, their last king, Tangaxoan, was tortured to death by Nuño de Guzmán. In 1810 they were the first to revolt against the Spaniards, and thus, under Hidalgo, began the Mexican War for Independence.

**TARASCON**, a town in the Provence department of Bouches-du-Rhône, France, 14 miles s.w. of Avignon. King René's castle, dating from 1400, is picturesque and well preserved, and a Gothic church (1187-14th century) is dedicated to St. Martha. It has manufactures of woollens and silks. Pop., about 9000.

**TARASQUE**, a monster prominent in the local folklore of Tarascon, France, said to have been subdued by St. Martha in early Christian days. On the fête "La Tarasque" an effigy of the beast is carried in procession about the streets of Tarascon.

**TARAWA**, a coral atoll of the Gilbert Islands (q.v.) in the S. Pacific Ocean, and administrative center of the Gilbert and Ellice Islands Colony (q.v.) of Great Britain. The atoll is roughly triangular in shape, enclosing a lagoon, and measures about 18 m. long on the E. side, 12 m. on the S. side, and 12.5 m. on the W. side. Tarawa is a continuous reef, and consists of a narrow string of forty-seven islands, with altitudes of from 8 to 10 ft. on two sides, and a lee barrier reef, with a single opening on the third side. Coconut palms, pandanus, and dense shrubs are the only vegetation. The lagoon is thickly studded with coral patches and reefs. Tarawa is noted as the site of the first American amphibious operation of the South Pacific campaign in World War II, and the scene of one of its fiercest battles. The Japanese navy raided the atoll on Dec. 10, 1941, and occupied it during Sept., 1942. On Nov. 18, 1943, U.S. Marine, naval, and air forces in great strength attacked the Japanese establishment, and landings were made on Nov. 22. About 4800 Japanese were strongly entrenched on the atoll. A bitter three-day

battle, in which the U.S. Marine Corps suffered about 3500 total casualties and the Japanese forces almost 4700 deaths, resulted before the Japanese were subdued. See WORLD WAR II.

**TARAXACUM**. See DANDELION.

**TARBELL**, EDMUND C. (1862-1938), American figure and landscape painter, born in West Groton, Mass. He studied with Bou langer and Lefebvre in Paris, but was most influenced by the Impressionists. He later settled near Boston, Mass., and attracted attention with his interesting and characteristic New England interiors. Among his best-known paintings are "Josephine and Mercie" (Corcoran Art Gallery, Washington); "Woman in Pink and Green" (Cincinnati Museum); "The Golden Screen" (Pennsylvania Academy of Fine Arts, Philadelphia); and "Girl Reading", among others in the Boston Museum. He became a member of the National Academy (1906), of the "Ten American Painters", and of the National Institute of Arts and Letters, and chairman of the council of the Boston Museum School. His many prizes include gold medals at the Pennsylvania Academy of Fine Arts, Philadelphia (1895 and 1911), and Carnegie Institute, Pittsburgh (1909 and 1923).

**TARBELL**, IDA MINERVA (1857-1944), American author, born in Erie County, Pa. She was editor of *McClure's Magazine* (1894-1906). Her writings, direct, vigorous, and notably informative, include; *Life of Napoleon Bonaparte* (1895); *Life of Abraham Lincoln* (1900); *History of the Standard Oil Company* (2 vols., 1904); *The Tariff in Our Times* (1911); *Life of Judge Gurney* (1925), and an autobiography, *All in the Day's Work* (1919).

**TARBES**, capital of the department of Hautes-Pyrénées, France, on the Adour, 30 miles S.E. of Pau. The cathedral is the principal building. There is a government cannon foundry, and also factories producing woolen goods and paper. Pop., about 30,000.

**TARBORO**, county seat of Edgecombe Co., N.C., situated on the Tar R., 70 miles E. of Raleigh. Transportation facilities include a railroad. The town is served by rail, and is the center of a rich agricultural area and an important market for peanuts, cotton, and bright-leaf tobacco. Industries in Tarboro are the manufacture of food products, textiles, lumber, concrete, metal products, and tractors. Tarboro is noted for its municipal

milk-pasteurizing plant, the only establishment of its kind in the U.S. Pop. (1950) 8120.

**TARDE, GABRIEL** (1843-1904), French sociologist and criminologist, born in Sarlat (Dordogne). In 1880 he began to contribute to the *Revue Philosophique*, and gradually won his way to reputation, which was assured after the publication of his *Lois de l'imitation* in 1890 (Eng. trans., "The Laws of Imitation", 1903). He later became professor of modern philosophy at the Collège de France in Paris. He elaborated a complete and original theory of society, essentially psychological. His psychological point of view is carried over into his criminological work. *La Criminalité Comparée* (1886), his first book, emphasized the social influences upon crime, with criticism of the anthropological school of Lombroso. *La Philosophie Pénale* (1890; Eng. trans., "Penal Philosophy", 1912) is a more systematic presentation of his ideas.

**TARDIEU, ANDRÉ** (1876-1945), French public official and author, born in Paris, and educated at the Lycée Condorcet and École Normale Supérieure. A former editor of *Le Temps*, he was a member of the Chamber of Deputies (1914-24, 1926- ), high commissioner of France to the United States (1917-19), minister of the Liberated Regions (1919-20), minister plenipotentiary at the Peace Conference and president of the League of Nations Control Commission during the same period. In the Chamber of Deputies in 1923, he led the Nationalist Party group which found Poincaré too lenient toward the Germans. He became minister of public works in Poincaré's cabinet in 1926. In November, 1929, the first Tardieu ministry was formed but lived only until Feb. 17, 1930. On March 2 he was called upon to form a new ministry. This, after maintaining a precarious hold on its majority over the summer months, finally was overturned on Dec. 4, following the spectacular Oustric crash. The Tardieu ministry again resumed office in 1932, but was defeated in the same year. Tardieu's writings include *Questions Diplomatiques de l'Année* (1904), *The Truth About the Treaty* (1921), and *France and America* (1927).

**TARDIGRADA**, a name given to the group or suborder of mammals containing the two genera of sloth. See *SLOTH*. The name "Tardigrada", or bear animalcules, is also given to an obscure order of Arachnids, including microscopic forms found in standing water.

They are capable of being completely dried without injury.

**TARDIVAUX, RENÉ**. See *BOYLESSE, RENÉ MARIE AUGUSTE*.

**TARE**. See *VETCH*.

**TARENTOLA** or **TARENTE**, one of the commonest geckos (q.v.), or lizards, of the Mediterranean region, *Tarentola mauritanica*. It is grayish brown with indefinite markings, and about 6 inches long. It has been introduced by ships into southern France, and when it takes up its abode inside a house becomes almost domesticated. Some other geckos are also mistakenly called by this name.

**TARENTUM**. See *TARANTO*.

**TARENTUM**, a borough of Allegheny Co., Pa., on the Allegheny River, 20 miles N.E. of Pittsburgh. There are manufactures of plate glass, bottles, tableware, paper, and iron and steel goods. It is in a coal-mining district. The place was settled and incorporated in 1842. Pop. (1950) 9540.

**TARGET AND TARGET PRACTICE**. Target practice is the scheme of instruction and training designed to produce effective use of projectile weapons under war conditions. The word "target" is used to designate either the actual or simulated hostile personnel or material. There are, e.g. special systems of target practice for: (1) small arms: including the rifle, the pistol, and the machine gun; (2) light and heavy field artillery: cannon from 3-inch to 6-inch; (3) siege artillery: from 6-inch to 16-inch caliber; (4) coast artillery: guns, mortars, submarine mines; (5) miscellaneous projectile weapons: hand and rifle grenades; army and navy antiaircraft guns for use against aircraft. Small arms and machine guns fired from aircraft against aircraft; bombs, torpedoes, and steel arrows launched from aircraft at land and water targets, etc.; and (6) naval guns and torpedoes fired from a moving ship or submarine against other ships in motion.

The general scheme of any system of target practice includes a preliminary training of the individual and organization in principles and methods, followed by tactical fire problems (with service ammunition), simulating as far as possible the technical and tactical conditions of a definite phase of actual combat. The targets for these final or test exercises simulate in form, color, size, movement, etc., the actual targets to be expected in war. The sole purpose of rifle training for the soldier is to make him a good shot under war conditions. United States



U. S. Army Signal Corps

*American soldiers at target practice on a rifle range*

soldiers using the rifle are graded according to proficiency exhibited in the individual record practice. The test is a single course in slow and in rapid fire as given in the accompanying table.

The grades of marksmanship, based on that range of firing (the number of points being those made out of a possible 300), are as follows: expert rifleman, 253, sharp shooter 238, marksman, 202, first class man 177, second class man, 152.

For machine guns which played so important a part in World War I, special target practice is provided. The squad handling a gun is practiced in directing the gun quickly upon a suddenly appearing target, in following its movements, and in keeping up

in effective fire against it. Field targets moving at various angles to the front and at different rates of speed are used. Such targets afford different and unknown ranges and different degrees of visibility.

The accuracy of fire of the rifleman is obviously dependent upon one man, that of the field gun upon a squad of five or more men and the skill of the officer observing the fire. Normally the rifleman cannot bracket his target by the observation of the points of impact of his bullets, whereas the field artillery officer can observe and uses the bursts of his projectiles for that purpose during the ranging process. The rifleman uses direct fire; he aligns his sights on the object attacked whereas the artillery gunner

**SLOW FIRE**

Range (Yards)	Time	Shots	Targets	Value	Position
300	No limit	10	A	50	5 sitting 5 kneeling
500	No limit	10	B	50	Prone
600	No limit	10	D	50	Prone sandbag rest

**RAPID FIRE**

200	1 min	10	D	50	Kneeling from standing
300	1 min 10 sec	10	D	50	Prone from standing
500	1 min 30 sec	10	D	50	Prone

Total possible

300 points





U S Army Photos, Official N M E Photo

TARGET PRACTICE *Top, left* Lowering a target to score a hit, at an army firing range *Top, right* Officers of the air corps firing 0.45-caliber pistols *Bottom* Firing M-1 rifles.

firing normally from behind cover, does not see his target but secures the correct laying of his gun by setting off on scales data computed by the officer observing the fire. The system involves team training at the guns, calculation of firing data by the officer and a sure communication system, verbal, telephone, or flag, from the officer's observing station to guns, and correction of range, height of burst, and deflection errors, based on the observation of preceding bursts. In addition, in the exceptional cases when field guns use direct fire, the enlisted gunner must have a training in laying his gun similar to that of the rifleman. The target practice of field artillery in the United States army includes pistol practice, subcaliber practice, and service practice.

To secure both efficiency and economy of material, practice with grenades thrown by hand is necessary. Practice with the various forms of rifle grenades, some of which have a range as great as 300 yards, is as necessary as target practice with trench mortars. The great value of such projectile arms was exemplified during World War I.

Antiaircraft gun is the name popularly given to the ground gun designed to attack aircraft. Their development and use during World Wars I and II was notable. Target practice with such guns is against kites, balloons, and swiftly moving targets towed by airplanes. The tremendous development of aerial warfare has led to important advances in target practice from the air as well as from the ground, especially in the dropping of bombs from aeroplanes. Targets used include marked ground areas and objects on land, floats and ships anchored at sea, and the like.

**TARGUL MURES**, formerly MAROS-VASARHELY, a town and capital of the department of Muresh-Turda, Transylvania, Romania. It was ceded to Romania by Hungary after World War I. It has a 15th-century Gothic church; the Teleki palace, with a library of 70,000 volumes; a college; gymnasias; and an industrial museum. Industries include the manufacture of sugar, tile, pottery, lumber, shoes, spirits, and the refining of petroleum. Pop., about 40,000.

**TARGUM**, the designation of the Aramaic paraphrases of the Old Testament used in the synagogues of Palestine and Babylonia. When Hebrew ceased to be generally spoken and gave way to the Aramaic, it became necessary to explain the meaning of what was read from the Scriptures. Only a small por-

tion of the immense mass of oral Targums that was produced survived. We possess the originally Judean Targum Onkelos and three late and incomplete so-called Jerusalem Targums on the Pentateuch, the Judean Targum on the Prophets, as well as later fragments of another paraphrase of the Prophets, and Targums on Psalms, Job, Proverbs, the five Megilloth (Song of Song, Ruth, Lamentations, Esther, Ecclesiastes), on chronicles, and on the deuterocanonical pieces of Esther.

**TARIFA**, a seaport town of Spain, in the province of Cadiz, on the coast, 21 miles s.w. of Gibraltar. It is the most southern town of Europe, is surrounded by tower-embattled walls, and is connected by a causeway with a small island, on which stand a fortress and lighthouse. Tunny and anchovy fishing is actively carried on. Pop., about 12,000.

**TARIFF**, a list or schedule of customs duties (q.v.) generally imposed by a government on imports and also, in some instances, on exports. Originally, such imposts were levied for the purpose of raising revenue. Following the growth of industry and the formation of national economies and nation-states in the 16th and 17th centuries, customs duties were imposed chiefly as instruments of national economic policy. Tariffs were imposed to protect domestic industries against foreign competition and to achieve a favorable balance of trade. These practices led to the levying by one government of high and often discriminatory imposts as an expression of hostility to another government: friendly governments were frequently accorded preferential tariff treatment. The peace treaties negotiated by the major warring powers of Europe during the 17th and 18th centuries often contained provisions for the reduction of tariffs, after 1700 virtually every treaty regulating commerce contained a most-favored-nation clause (q.v.), obligating the signatories to extend to each other treatment equally favorable to that extended to other nations; see **COMMERCIAL TREATIES**.

In the 19th century tariffs continued the upward trend begun in the preceding centuries. A conspicuous exception comprised the free-trade (q.v.) policy of England. The upward trend in tariffs continued in the 20th century and was intensified during the world economic depression of the 1930's; in 1932 England departed from its historic free-trade policy when it instituted an *ad valorem* duty of 10 percent on almost all imports. The

adverse effect on world trade of high tariffs and such accompanying restrictive measures as the import and export quotas adopted by some countries gave rise to efforts to reduce or eliminate those barriers to international commerce; a notable example was the U.S. policy, beginning in 1934, of negotiating with other countries bilateral agreements providing for the reciprocal reduction of tariffs and other barriers to trade; see **RECIPROCITY**. Another instance of the same tendency was the customs union (q.v.) formed after World War II by Belgium, The Netherlands, and Luxembourg and known as Benelux (q.v.), which abolished customs duties on trade among the member states and established uniform duties on trade originating in non-member states. After its establishment in 1945, the United Nations sponsored measures to promote world trade, including the lowering tariff barriers; see **INTERNATIONAL TRADE ORGANIZATION**. See also **COMMERCE**; **FOREIGN TRADE**. For a discussion of the tariff policy of the United States, see **TARIFFS, UNITED STATES**.

**TARIFF COMMISSION, UNITED STATES**, an independent agency of the executive branch of the U.S. government, created by Congressional enactment in 1916 to conduct investigations and studies of matters relating to U.S. tariffs. Pursuant to the act of 1916 and subsequent amendatory legislation, the Tariff Commission investigates the administration of the U.S. customs laws and the effects of the laws on U.S. industry and the fiscal position of the Federal government. It studies tariff relations between the United States and foreign countries and is charged with the duty of ascertaining whether foreign countries have instituted discriminatory practices, charges, regulations, or laws against the commerce of the United States. The Commission studies the competition of foreign industries with those of the United States and advises the President with regard to the level of import duties necessary to protect domestic industry against serious injury from foreign competition. It investigates allegations of unfair methods of competition and unfair acts in the importation and sale of imported articles in the United States. The Commission also compiles *Summaries of Tariff Information*, containing statistical and other pertinent data on the production, import, and tariff rates of the approximately two thousand commodities included in the dutiable schedules and on the free list of the U.S. customs laws.

The Tariff Commission makes its investigations and studies either on its own initiative or at the request of the President, either house of Congress, the Ways and Means Committee of the House of Representatives, or the Senate Finance Committee. It makes an annual report to Congress on its activities. The Commission consists of six members, each of whom serves for a six-year term, and all of whom are appointed by the President with the approval of the Senate. No more than three members of the Commission may be of the same political party. The chairman and vice-chairman of the Commission are designated annually by the President from the membership of the Commission.

**TARIFFS, UNITED STATES**. Prior to the establishment of the United States, customs duties (q.v.), were imposed by England on colonial commerce, and were levied by almost all the colonial assemblies virtually from their inception. The colonial imposts, generally comprising *ad valorem* duties of one to five percent, were intended to raise revenue; protect colonial trade against foreign, including English, competition; retaliate against discriminatory treatment abroad; and, in accordance with custom and prevailing religious beliefs, notably in the northern colonies, discourage the use of ostentatious apparel and the consumption of liquor. Most colonial imposts comprised either general tariff schedules which included especially import duties on wines and liquors, or such specific taxes as export duties on tobacco or other agricultural products, import duties on slaves, and tonnage duties on shipping based on the tonnage of the cargo.

In drafting the United States Constitution, the Founding Fathers empowered Congress in Article I "to lay and collect taxes, duties, imposts and excises" and "to regulate commerce with foreign nations". The first enactment made by Congress was the Tariff Act of 1789. That tariff was intended to encourage the domestic manufacture of glass, earthenware, and other products, but its primary purpose was to raise revenue; it provided for an average rate of duty of about 8½ percent. Subsequently, customs duties were raised from time to time, but no important changes in the tariff were made until 1816.

The tariff instituted in 1816 resulted from changes in the national economy occasioned by the Embargo Act (q.v.) and Non-Inter-course Acts, passed by Congress in 1807 and 1809, respectively, and by the War of

1812, all of which greatly curtailed American trade with Europe and gave a powerful impetus to the development of domestic manufactures. The tariff of 1816 was protectionist (see PROTECTION) in character and was intended to foster the production principally of textiles, hats, leather, paper, and cabinetwork. Demands for protection for other industries, notably by manufacturers of woollen and hempen products, glassware, and iron and lead products, led to a general upward revision of the tariff in 1824. Because that tariff resulted in higher prices of articles used in the agricultural South, it was bitterly denounced by representatives of the southern States.

Continued demands for greater protection, especially on the part of woollen manufacturers, led to the enactment of the tariff of 1828, which provided for the highest rates up to that time and was later popularly called the "tariff of abominations". It was bitterly denounced in the South and was also opposed by Northern interests adversely affected by the high customs duties on molasses, sailcloth, and raw wool. Persistent agitation against the tariff of 1828 resulted in the enactment in 1832 of a law which established rates approximating those of 1824. South Carolina, however, was not appeased and declared null and void the tariff acts of both 1828 and 1832. The ensuing political crisis threatened to disrupt the Union, as President Andrew Jackson threatened to use force to compel the submission of South Carolina; see NULLIFICATION. A clash was averted by the adoption by Congress of the so-called compromise tariff of 1833, introduced by Henry Clay (q.v.), which provided for a gradual reduction until 1842 of certain high customs duties. For a time these reductions were made, but after national revenues were seriously reduced in consequence of the economic crisis of 1837, tariff rates were increased; the level of duties established by the Tariff Act of 1842, sponsored by the Whigs (see WHIG PARTY), was approximately that of 1832.

In the administration of President James Polk the Democrats achieved control of national legislation and, in 1846, instituted a tariff frequently, but not entirely accurately called, a free-trade (q.v.) tariff. That tariff established moderate duties which protected various industries by the imposition of *ad valorem* duties averaging about 30 percent. Congress again lowered

customs duties in 1857, but before they became effective, the economic crises which occurred in that year led to the reinstatement of the previous duties.

The outbreak of the Civil War imposed on the Federal government the pressing necessity of raising huge sums of money and led, in 1862, to the levying of heavy excise taxes on domestic manufactures and correspondingly high duties on imports. The tariff was thus transformed from a protectionist measure into an instrument for raising revenue. Tariff rates were again increased in 1864 to an average level of 47 percent. After the war, excise taxes were almost entirely abolished, but efforts to reduce the tariff encountered resistance from those who benefited from it, and the tariff again became a protectionist instrument. In 1870 duties on such articles as coffee, tea, and sugar, which did not affect protected interests, were lowered. In 1872 a number of such duties were abolished, and a general reduction of 10 percent was made in tariff rates, in 1875 the 10 percent reduction was repealed.

During the rapid industrialization of the United States in the latter part of the 19th century, the Republican Party, as the representative of the growing manufacturing interests of the country, became the advocate of high tariffs, and the Democratic Party, which had revived after the Civil War as a party of opposition, became a proponent of low tariffs; see POLITICAL PARTIES IN THE UNITED STATES; DEMOCRATIC PARTY; REPUBLICAN PARTY. Large Treasury surpluses led President Grover Cleveland, a Democrat, to make a vigorous attack, in his Presidential message to Congress in 1887, on the prevailing high tariff; and the tariff became the principal issue in the Presidential election campaign of 1888, won by the Republican candidate Benjamin Harrison. His election was followed by enactment in 1889 of the McKinley tariff, raising the duties on many manufactured articles and raw materials. The re-election of Cleveland in 1892 led to the Wilson Tariff of 1894, which abolished the duty on wool and other raw materials and reduced the imposts on such articles as woollen goods.

Tariff rates were increased to the highest level (57 percent) since the Civil War in the Republican administration of President William McKinley by the Dingley Tariff of 1897, which reimposed the duty on wool.

However, some reduction in the level of customs duties was made by amendatory legislation in 1900. The continuing opposition to high tariffs began to be evident also in the Republican Party, which made a pledge in the Presidential election campaign of 1908 to revise the tariff downward. The Payne-Aldrich Tariff Act of 1909 made some reductions in rates, but did not satisfy the widespread clamor for lower customs duties. After the return of the Democrats to power as a result of their victory in the Presidential and Congressional elections in 1912, President Woodrow Wilson sponsored the Underwood Tariff of 1913, which reduced the levies on manufactured and semi-manufactured articles, eliminated the duties on most raw materials, and provided for the eventual abolition of the import tax on sugar. The outbreak of World War I drastically curtailed U.S. foreign trade, and the tariff did not again become an important problem in the United States until the economic depression of 1920-21 focused the attention of the country on economic problems.

The Emergency Tariff Act of 1921 was followed by the Fordney McCumber Tariff of the following year. These measures, sponsored by the Republican administration of President Warren Harding, reinstated the traditional Republican high tariff policy. In some cases, customs duties were increased to the highest level in U.S. tariff history. The Fordney McCumber Tariff Act introduced an innovation in American tariff policy by empowering the President to increase or decrease customs duties in accordance with provisions stipulated in the act, in order to prevent untair practices in the import trade and to retaliate against discrimination by foreign countries against U.S. trade; see **TARIFF COMMISSION, UNITED STATES**. Another notable high tariff law, the Hawley Smoot Tariff Act, was enacted in 1930 in the administration of President Herbert Hoover; the Hawley-Smoot Tariff raised customs duties by an average of approximately 20 percent and continued the flexible-tariff provisions of the Fordney-McCumber Tariff.

During the world-wide economic depression of the 1930's, which resulted in a precipitate decline in international trade and in a sharp increase in tariffs and other barriers to commerce in many countries, the Democratic administration of President Franklin Roosevelt abandoned the historic

tariff policy of the nation. In an effort to revive U.S. foreign trade and contribute to a revival of world commerce, the United States in 1934 instituted a policy of negotiating with other countries bilateral agreements, called reciprocal trade agreements, providing for the reciprocal reduction of tariffs and other barriers to trade; see **RECIPROCITY**. Successive Congresses under Roosevelt and his successor, President Harry Truman, maintained the policy of tariff bargaining by renewing the Presidential power to negotiate the reciprocal trade agreements. In July, 1953, Congress, at the request of President Dwight D. Eisenhower, extended the legislation providing for reciprocal trade agreements until June 12, 1954.

**TARIJA**, a department of south Bolivia. Its boundaries are ill defined. There are extensive forests and large stretches of grazing land. The chief river is the Pilcomayo. The principal industries are agriculture and stock raising, both undeveloped. Extensive mineral resources, especially silver, are unworked. The population is sparse and mostly in the mountainous region. The capital is Tarija. Area, 31,567 sqm; pop (1950) 126,752.

**TARIJA**, capital town of the department of Tarija, Bolivia, on the upper course of the Yermayo, 180 miles s. of Sucre, near the border of Argentina, with which it has extensive trade. The climate is pleasant. Pop (1950) 16,869.

**TARIK**, IBN Z'AD (d. 720?), leader of the first Moslem invasion of Spain. He was a Berber, and had been converted to Mohammedanism by the emir Musa, who made him governor of Tangier. It was probably on April 30, 711, that Tarik landed at Gibraltar (i.e., *Dubal Tarik*, "the hill of Tarik") with a force of 7000 men. He speedily overran Andalusia, and on July 19, 711, the Visigothic king Roderick was defeated, near Vejer, or Jerez, de la Frontera. The jealousy of Musa led to Tarik's recall and disappearance.

**TARIM**, the principal river of Chinese Turkestan. It rises in the Karakorum Range in the extreme northern part of Kashmir, and flows north, east, and southeast through the great desert basin of Turkestan, emptying into the collection of lakes and marshes known as Lob Nor at the northern base of the Altyn-Tagh. Its length is estimated at over 1000 m., including the



Booth Tarkington

upper course, which is generally called the Yarkand.

**TARKINGTON, (NEWTON) BOOTH** (1869-1946), American novelist, born in Indianapolis, Ind. He was one of the group of Hoosier (Indiana) writers, which included also notably, Edward Eggleston, James Whitcomb Riley, and Meredith Nicholson. His first published novel, *The Gentleman from Indiana* (1899), is a realistic study of life in a small midwestern town. *Monsieur Beaucaire* (1900) is a romance of 18th-century England. *Penrod* (1914) is an amusing study of a small boy, and *Seventeen* (1916) treats of a very young man in the same style. Among his other books are *The Magnificent Ambersons* (1918), for which he was awarded the Pulitzer Prize; *Alice Adams* (1922), also a Pulitzer Prize winner; *Gentle Julia* (1922); *Plutocrat* (1927); *The World Does Move*, reminiscences (1928); *Young Mrs. Greeley* (1929); *Presenting Lily Mars* (1933); *Little Orvie* (1934); *The Fighting Littles* (1941); and *Kate Fennigate*. His plays are for the most part light and entertaining. The most important are *Master Antonio* (1916), *Clarence* (1919), *The Intimate Strangers* (1921), *Rose Brier* (1922), and *Colonel Satan* (1930).

**TARLAC**, a province of Luzon, Philippine

Islands. Rice and sugar cane are the principal agricultural products, although some tobacco and corn are raised in the higher altitudes. The forests of the province are of great value; oranges, lemons, and bananas are produced in great variety. The languages are Tagalog, Pampango, and Pangasinan. The capital is Tárlac. Area, 1205 sq m, pop., about 140,000.

**TARLAC**, capital of the province of Tárlac, Luzon, Philippines, on the right bank of the river of the same name, a tributary of the Agno, 73 miles N.W. of Manila. It is on the Manila and Dagupán Railroad, and has excellent road connections with surrounding towns. Pop., about 14,000.

**TARLETON, SIR BANASTRE** (1754-1833), English soldier in the American Revolutionary War, born in Liverpool, and educated at Oxford. In 1776 he took part in Clinton's operations against Fort Moultrie. With the army under Howe, he took part in the battles of Brandywine and Germantown and the occupation of Philadelphia. He was an able and intrepid cavalry leader, but gained a reputation for cruelty until Tarleton's quarter came to mean general butchery. Dispatched to the south by Cornwallis, he defeated the force of Buford at Waxhaw Creek, May 29, 1780, routed part of Gates' force at Camden, and defeated Sumter at Catawba Fords. On Jan. 17, 1781, he was defeated by Morgan at Cowpens. He was with Cornwallis at the final surrender and returned to England in 1782. He was made major general (1794), governor in Berwick and Holy Island (1808), general (1812), and baronet (1815). He wrote a *History of the Campaigns of 1780 and 1781 in the Southern Provinces of North America* (1787).

**TARLTON, RICHARD** (d. 1588), English comedian of Queen Elizabeth's time. Little is known of his life, but he is said to have been born in Shropshire and to have been at one time keeper of a public house. As an actor he became in 1583 one of the queen's players, and was noted for his witticisms. A collection of jokes called *Tarlton's Jests* was published a few years after his death. He is said to have been the Yorick referred to in Shakespeare's *Hamlet*.

**TARN**, a department of south France, in Languedoc. Coal, iron, copper, and lead are mined, and there are deposits of gypsum and porcelain clay. The vine is extensively cultivated, and there are manufactures of spirituous liquors, woolens, cottons, silks, iron,

leather, and paper. Albi is the capital. Area, 2231 sq.m.; pop. (1946) 298,117.

**TARN-ET-GARONNE**, a small department in the south of France, bounded on the s.e. by the department of Tarn. The principal river is the Garonne, with its affluents the Tarn and Aveyron. The climate is temperate. Cereals are raised, as well as wine, fruit, and hemp. There are some manufactures of silk, paper, candles, and soap. Montauban is the capital. Area, 1440 sq.m.; pop. (1946) 167,664.

**TARNISH.** See CORROSION.

**TARNOPOL**, a former Polish town, situated in the portion of E. Poland ceded to the Soviet Union following World War II. It lies on the Seret R., 87 miles E.S.E. of Lwów (Lemberg). Industries in Tarnopol include corn milling, brewing, distilling, and the processing of honey and wax. Tarnopol was founded in 1540, and later was made a fortified town which was given generous privileges by Polish kings. In the first partition of Poland (1772), Tarnopol was included in the Galician area annexed by Austria. During World War I, Tarnopol was the site of two battles between the Russians and the Austro-German forces. Pop., about 36,000.

**TARNÓW**, a city of Poland in the province of Kraków, situated on the Dunajec R. near its confluence with the Biala R., 137 miles W. of Lwów. The principal edifices are the 15th-century cathedral, the old town hall, and a diocesan museum. Industries include the manufacture of flour, lumber, agricultural implements, and glass. During World War I Tarnów, then in Austria-Hungary, was taken by Russian troops in late 1914, but in the spring of 1915 was recaptured by Austro-German forces. During World War II Tarnów was held by German forces from 1939 to the beginning of 1945. Pop., about 45,000.

**TARO** or **COCCO**, common name for any of several perennial herbs belonging to the genus *Colocasia* of the Arum family. The genus, which contains five known species and many varieties, is native to tropical and subtropical regions throughout the world, and is cultivated extensively in the warm-temperate regions of China, Japan, Syria, Egypt, New Zealand, and the United States for its large, starchy, edible roots popularly called *eddoes*. The inconspicuous, petal-less flowers, arranged in spadices along the branches, have no floral envelope and either stamens or pistils. The fruit is usually a berry. The principal species of taro is *C.*



*Taro (Colocasia esculenta)*

*esculenta*, commonly known as elephant's ear (q.v.) and cultivated mainly throughout the Hawaiian Islands. It is eaten mostly in the form of *poi*, a sticky pastelike substance prepared first by boiling or steaming the eddoes, peeling and then pounding or grinding them with water, and finally letting the mash ferment for several days. Like the potato, the taro root is also often eaten par-boiled and baked. The young, unopened leaves, called *luau*, are prized as greens, and are eaten after being boiled with baking soda or cooked with fatty meat. The popular American variety of *C. esculenta*, commonly referred to as *Trinidad dasheen* or *dasheen*, was introduced in the southern part of the United States in 1905 from Trinidad and Puerto Rico. It is grown in moist, sandy loams of the south Atlantic and Gulf States, and, like the potato, is cooked for table use. The Egyptian and Indian species of taro, *C. antiquorum*, is an inferior but edible plant referred to in Egypt as *qolqas*.

**TAROT** or **TAROC**, a card game which originated in Italy in or before the 14th century; and also the name of the kind of card, having a checkered or gridded back, with which the game is played. A pack of tarot cards consists of seventy-eight, twenty-two of which are trumps. The game is still popular in Germany, Austria, and parts of France.

**TARPAULIN**, strong linen or hempen cloth, coated with tar or pitch to render it waterproof. An elastic pitch from bone tar or stearin residues is used by tarpaulin makers.

**TARPEIA**, in Roman religion, a local divinity, probably a goddess of the lower world. According to a well-known legend, Tarpeia was the daughter of the governor of the citadel on the Capitoline Hill in the time of Romulus, the founder of Rome and its first legendary king. Being covetous of

the golden ornaments worn by the Sabine soldiers, and tempted by their promise to give her those they wore on their left arms, she opened a gate of the citadel to the Sabine king, Titus Tatius (q.v.), who had come to avenge the rape of the Sabine women. The Sabines, however, then crushed Tarpeia to death beneath their shields and threw her body off a cliff. The Tarpeian Rock, on the s.w. corner of the Capitoline, from which criminals were, from early Roman times, thrown to their death, is said to have been named after her.

**TARPON**, a food fish of America belonging to the Clupeidae or Herring family. It is common in the warmer Atlantic waters and off the shores of the Gulf States, and attains a length of 6 ft., and a weight of over 100 lb.

**TARPON SPRINGS**, a town of Pinellas Co., Fla., situated near the mouth of the Anclote R., about 21 miles n.w. of Tampa. The town, which occupies a picturesque site along Spring Bayou, is the center of the sponge-fishing industry in the United States. Spring Bayou and its various arms provide about 25 m. of water front, and the town's fishing fleet consists of more than 170 vessels. The Tarpon Springs Sponge Exchange, on which the catch is auctioned, is the busiest of its kind in the world. Most of the sponge fishermen are Greek immigrants, who began to settle in the town in 1905, or of Greek descent. To a considerable extent, the fishermen have retained their national culture and customs, giving Tarpon Springs the atmosphere of a small Mediterranean seaport. The Epiphany ceremony, an ancient Greek Orthodox rite symbolizing the baptism of Christ, the descent of the Holy Spirit, and the Recovery of the Cross under Constantine the Great, is celebrated in the town annually on January 6.

Because of its quaintness and recreational facilities, Tarpon Springs is a popular vacation and tourist resort. The Gulf of Mexico is readily accessible for surf bathing and deep-sea fishing. Nearby Lake Butler, 8 m. long, and the Anclote R. afford excellent opportunities for fresh-water fishing. Wall Springs, less than 3 m. to the s. of the town, is noted for its warm, spring-fed pool. Other points of interest in Tarpon Springs include Coburn Park, the municipal golf course, a municipal pier on the Gulf of Mexico, Greek curio shops, and the Church of the Good Shepherd. The last-named edifice contains a collection of religious paintings by the American landscape painter George Inness, Jr.

Tarpon Springs was founded in 1882. Pop. (1950) 4323.

**TARQUINIA** (anc. *Tarquini*), formerly CORNETO, a town of central Italy in the province of Viterbo, situated on the Tyrrhenian Sea, 62 m. by rail n.w. of Viterbo. It is built on a lofty height, 490 ft. above sea level. Tarquinia contains many medieval buildings, including twenty-five medieval towers. A notable museum containing antiquities from the neighboring ruins is in the Palazzo Vitelleschi, built in 1439. In the vicinity are many Etruscan tombs, and the necropolis is a famous archeological site. About a mile distant are the ruins of the ancient city of Tarquinii, the head of the twelve cities of the Etruscan league and later, under Roman control, a municipium. The Roman town suffered several Saracen raids during the Middle Ages, and in 1307 its remains were destroyed by the medieval inhabitants and used to build the city of Corneto; see ETRURIA. Pop. of town, about 6400, of commune, about 8000.

**TARQUINIUS** or **TARQUIN**, the family name of two legendary kings of ancient Rome. 1. **LUCIUS TARQUINIUS PRISCUS** (reigned 616-578 B.C.), fifth king, the son of a Corinthian noble and an Etruscan woman. He emigrated with his wife Tanaquil from Etruria to Rome, and was elected king by the Roman senate upon the death of Ancus Marcius. To Tarquinius are ascribed the construction of the great *cloaca* or sewers, the laying out of the Circus Maximus, the institution of the *ludi Romani* or Roman games (see FESTIVALS AND FLASIS. *Roman Festivals*), and the foundation of the great temple to Jupiter on the Capitoline Hill (see JUPITER CAPITOLINUS, TEMPLE OF). 2. **LUCIUS TARQUINIUS SUPERBUS** (reigned 534-510 B.C.), seventh and last king of Rome, the son of Tarquinius Priscus. He usurped power after the murder of his father-in-law, Servius (q.v.) Tullius, his predecessor on the throne. Tarquinius Superbus completed the temple of Jupiter Capitolinus begun by his father and deposited in the vaults the Sibylline Books which he had purchased from the Sibyl (q.v.) of Cumæ. After the rape of Lucretia (q.v.) by the king's son, Sextus, the Romans rose against their tyrant, who was deposed and forced to flee with his sons in 510 B.C., a republic being established at Rome the following year. Later attempts to restore Tarquinius to the throne by force were unsuccessful (see PORSENA). The expulsion of the Tarquins has been in-





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*A typical tarsier, showing the large glassy eyes and long fingers*

terpreted as a revolt of Romans and Sabines against the domination of Rome by the Etruscans, and the similarity of the achievements of the two kings has led many modern scholars to believe that Priscus and Superbus are different names for the same king.

**TARRAGON**, common name applied to an aromatic, bitter, perennial herb, *Artemisia dracunculus*, belonging to the Thistle family and native to Siberia and the regions surrounding the Caspian Sea. It reaches a height of 2 feet and is cultivated as a culinary herb in w. Europe. The yellowish to purplish flowers, which are arranged in panicled spikes or racemes, have a tubular calyx, a five-lobed corolla, five stamens, and a

solitary pistil. The fruit is a one-seeded, dry achene. The green parts of the tarragon plant are used throughout Europe for seasoning salads and for flavoring pickles, vinegar, and mustard. An unrelated plant, *Tagetes lucida*, has a flavor and odor similar to that of tarragon, for which it is often used as a substitute.

**TARRAGONA**, a seaport of Spain, chief city of the modern province of Tarragona, situated on the Mediterranean shore, at the mouth of the Francolí, 60 miles w. of Barcelona. The industries are spinning and weaving (chiefly in silk, also in jute), and felt and lace making. But of much greater importance is the shipping and transport trade. The monks of the Grande Chartreuse

established their liqueur distillery here in 1903, on being forced to leave France. Pop. of town, about 31,000. Area of province, 2426 sq.m.; pop. (1950) 370,057.

**TARRANT CITY**, a city of Jefferson Co., Ala., situated about 6 miles N.E. of the center of Birmingham. The city, which is served by a railway, lies in the Birmingham industrial region, widely noted for the production of iron, steel, heavy machinery, cast-iron pipe, textiles, and garments. Pop. (1950) 7571.

**TARRASA**, a town in the province of Barcelona, Spain, 22 miles N.W. of the city of Barcelona. It is an important industrial center, with manufactures of cotton and woolen cloths. The Romanesque churches of San Pedro and San Miguel date from the Christian reconquest. Pop. (1950) 60,080.

**TARRYTOWN**, a village of Westchester Co., N.Y., situated on the E. bank of the Hudson R. where it expands into the Tappan Zee, and 21 m. by rail N. of New York City. It adjoins the village of North Tarrytown (q.v.), and is opposite Nyack, with which it is connected by terry. Tarrytown is an attractive residential suburb of New York City. The history of Tarrytown and North Tarrytown dates from the Dutch occupation of the Hudson R. valley, and the villages were the scene of numerous encounters during the American Revolution. The main street of Tarrytown is a part of what once was the old King's Highway, from New York City to Albany, constructed in 1723. The American author Washington Irving immortalized the region of the Tarrytowns in his famous story, *The Legend of Sleepy Hollow*. Irving's home in Tarrytown, "Sunnyside", is maintained as a historic shrine and contains collections of Irving's personal belongings and manuscripts. Educational institutions in the village include Marymount College (Roman Catholic) for women, established in 1907. Tarrytown was incorporated as a village in 1870. Pop. (1950) 8851.

**TARSHISH**, probably the same as *Tartessus*, the Latin form for the Greek name of a city and emporium of the Phenicians in Spain, near the mouth of the Guadalquivir, but used of the whole region—subsequently known as Andalusia. It is frequently mentioned in Scripture (see Ezek. 27:12).

**TARSIER**, common name applied to any of the primates constituting the genus *Tarsius* and family Tarsiidae, and belonging to the

suborder which includes also the true lemurs (q.v.). Tarsiers are found in the East Indies and the Philippine Islands. The animals are brownish-gray, with large, rounded heads, the most conspicuous features of which are enormous, gogglelike eyes. The muzzle is short; the ears are long and pointed. The animals are slightly smaller than full-grown rats, and have soft, furry bodies and slender limbs. The hind limbs are especially modified for locomotion by leaping. The fingers and toes are extremely long and are equipped with fleshy sucking discs. The tail is long and ends in a tuft of hairs. The animals are arboreal and forage for food, usually insects and lizards, only at night. The typical tarsier, *T. spectrum*, has olive markings on its body and black markings on its head and face.

**TARSIPES**, a small Australian honey-sucking marsupial, of the family Phalangistidae, about the size of a mouse.

**TARSUS**, a town of Turkey, anciently chief city of Cilicia, and one of the most important in Asia Minor, on the river Cydnus, 12 m. from the sea. It was a great emporium for the traffic carried on between Syria, Egypt, and the central region of Asia Minor. It was the birthplace of the apostle Paul. It exports corn, cotton, wool, galls, wax, goats' hair, skins, and hides. Pop. about 22,000.

**TARTAGLIA**, NICCOLÒ, originally NICOLA FONTANA (1500?-57), Italian physicist and mathematician, born in Brescia. He lectured in Verona, and became professor of mathematics in Venice. Tartaglia first became generally known through his solution of cubic equations, and from his suggestions Cardan probably derived the solution known as Cardan's method. His work in physics is preserved in his *Nuova Scienza* (1537; French trans., 1845-46), showing that he studied the theory of falling bodies and investigated the range of projectiles at various angles.

**TARTAN**, a fabric, properly of wool, having varicolored lines or stripes at right angles forming a distinctive pattern, particularly that worn by Scottish Highlanders.

**TARTAR**, a mixture of bitartrate of potash and tartrate of lime. It is a deposit formed from wine, and is known in its crude form as argol.

**TARTAR EMETIC**, ANTIMONY AND POTASSIUM TARTRATE, TARTRATED ANTIMONY, or STIBIATED TARTAR, common name applied to a chemical compound  $\text{KSBiO}_4 \cdot \text{H}_2\text{O}$ , widely used in medicine. The compound is ob-

tained as colorless rhombic crystals or as a white powder, is odorless, and has a bitter-sweet metallic taste. It has a specific gravity of 2.6 and melts at 100°C. (212°F.). It is soluble in water and glycerine but is insoluble in alcohol. Tartar emetic was formerly used extensively to induce sweating and vomiting, but, because it is often toxic in doses large enough to induce secretion, it is little used for these purposes today. The most important contemporary use for tartar emetic is as a parasiticide, especially in such diseases as trypanosomiasis, schistosomiasis, and leishmaniasis. Tartar emetic is also used to promote mucus secretion in severe cases of bronchitis. The drug is administered by mouth or intravenously; intramuscular or subcutaneous injections are not administered because tartar emetic tends to induce inflammation when localized in the body.

**TARTARIC ACID**, or DIHYDROXYSUCCINIC ACID, an organic acid, formula  $C_4H_4O_6$ , found in many plants and known to the early Greeks and Romans as *tartar*, the acid potassium salt derived as a deposit from fermented grape juice. The acid was first isolated in 1769 by the Swedish chemist Karl Wilhelm Scheele, who boiled tartar with chalk and decomposed the product with sulfuric acid (q.v.). Several varieties of the acid are known, the most important of which, dextrotartaric acid, exists as potassium or calcium tartrates in the juice of grapes, tamarinds, pineapples, and mulberries (qq.v.). When this juice is fermented, the acid salts form a white crust, called *argol* or *lers*, on the inner surface of its container. Argol, boiled with dilute hydrochloric acid, precipitates as calcium tartrate when calcium hydroxide is added. Dextrotartaric acid is then liberated upon addition of dilute sulfuric acid. Dextrotartaric acid has a melting point of 170°C. (338°F.), is extremely soluble in water and alcohol, insoluble in ether, and rotates the plane of polarized light to the right. It gives off carbon dioxide when exposed to ultraviolet light and reduces all ammoniacal silver compounds. In the presence of manganese dioxide,  $MnO_2$ , it yields large amounts of acetaldehyde and carbonic acid, and is reduced by hydriodic acid and phosphorous to malic and succinic acids. If the argol is purified by treatment with animal charcoal and further crystallized, the white, crystalline, gritty substance known as *cream of tartar* is produced.

• Another variety, levotartaric acid, does not occur in nature, but is formed by the crystallization of the salts of racemic acid. It was first prepared by the French chemist Louis Pasteur from sodium ammonium racemate, and is virtually identical with dextrotartaric acid, except that it rotates the plane of polarized light to the left. Racemic acid,  $(C_4H_4O_6)_2 \cdot H_2O$ , found with dextrotartaric acid in certain grapes, has a melting point of 206°C. (402.8°F.), is moderately soluble in cold water or alcohol, and exhibits no optical activity. It may be prepared by the oxidation of fumaric acid (q.v.); by the mixture of equal molecular proportions of dextro and levotartaric acids; or by heating dextrotartaric acid for several hours with caustic alkalis. The fourth variety, mesotartaric acid, has a melting point of 140°C. (288°F.) and is optically inactive. It is produced by the oxidation of maleic acid, or is formed together with racemic acid when ordinary tartaric acid is heated with caustic alkalis.

Dextrotartaric and levotartaric acids are widely used as a mordant in wool dyeing; in photography for printing and developing; and in the production of baking powders and Seidlitz powders. In medicine, it is used to make cooling drinks for diabetic and feverish patients, and, as cream of tartar, is employed as a mild cathartic. Sodium potassium tartrate, the colorless crystalline salt known as *Rochelle salt*, forms Fehling's solution (q.v.) with  $CuSO_4$ , and is used extensively in urine analysis.

**TARTARS.** See TARTARS.

**TARTARUS**, according to the Greek poet Homer, a deep and sunless abyss, as far below Hades (q.v.) as the earth is below the heavens, and closed in by iron gates. Into Tartarus Zeus, father of the gods, hurled those who rebelled against his authority, such as Kronos and the Titans (qq.v.). The name was later employed sometimes as a synonym for Hades, or the underworld in general, but more frequently for the place of damnation where the wicked were punished after death. In Tartarus were placed such legendary sinners as Ixion, Sisyphus, Tantalus, and Tityus (qq.v.).

**TARTARY**, the name which, in the Middle Ages, was applied to the central part of Eurasia. In later times a distinction was made between European and Asiatic Tartary, the former comprising that part of Russia which was once the khanate of the Crimea. The term "Asiatic Tartary", first ap-

plied to the whole of central Asia, has gradually been confined to Turkestan.

**TARTE, JOSEPH ISRAEL** (1848-1909), Canadian statesman, born in the province of Quebec, and educated at L'Assomption College. He was admitted to the bar in 1871. Afterward he became editor of *Le Canadien* and then of *L'Événement*, in Quebec. He was a member of the legislative assembly of Quebec, 1877-81, and became an active political organizer of his party in that province. After his election to the Dominion House of Commons in 1891, as an Independent Conservative, he attacked the administration of Sir John A. Macdonald, his political chief, alleging corrupt practices by ministers. This compelled him to leave the Conservative Party, and when the Laurier administration came into power in 1896 he was appointed minister of public works. He held that position until 1902. He was afterward political editor of *La Patrie* of Montreal.

**TARTINI, GIUSEPPE** (1692-1770), celebrated Italian musician and composer, born in Pirano, Istria. He became solo violinist in the chapel of San Antonio, Padua. Tartini was considered one of the greatest violinists of all time, an eminent composer, and a scientific writer on musical physics. His best-known work is the famous sonata, *Il Trillo del Diavolo*.

**TARTRATES.** See **TARTARIC ACID**.

**TARTU**, formerly **DORPAT**, a city of the Estonian S.S.R., situated on the Embach R., 163 miles s.w. of Leningrad. Dikes protect city from floods of the river. After a fire in 1777 the ancient fortifications of the city were converted into promenades and ornamental gardens. Tartu is the intellectual center of Estonia, and its university, chartered in 1632 and with facilities for over 3200 students, is celebrated, particularly for its astronomy department.

According to Estonian tradition, the city was founded in 1030 by Yaroslav, grand prince of Kiev. It was captured by the Teutonic Knights in 1224 and a year later became the seat of a bishopric with a cathedral. Under the rule of the Knights the city, as Dorpat, developed into a commercial center and, in the 14th century, entered the Hanseatic League. In 1558 Russia captured Dorpat, but in 1582 ceded it to Poland. It was subsequently taken by Sweden in 1600, recaptured by Poland in 1603 and, after several subsequent changes in control, was finally ceded to Russia in 1704. Following

the Russian Revolution of 1917 the newly organized Estonian national army occupied the city on Feb. 22, 1918. Two days later, German forces captured it; in Dec., 1918, it was taken by Soviet troops, and retaken by Estonia on Jan. 14, 1919. With the establishment of the Estonian republic in 1918, the city was renamed Tartu ("lowland of Tar"), for a god of Estonian mythology. In 1920 the city was the site of a peace conference between Estonia and Soviet Russia. Pop., about 72,000.

**TARTUFE** or **TARTUFFE**, the name of Molière's most celebrated comedy and of the chief character in it, who has become the type in all languages for a hypocritical scoundrel carrying out his evil designs under the cloak of religion. In the play Tartufe ingratiate himself with a simple minded gentleman named Orgon, and nearly ruins both him and his family before being discovered. The name is said to have suggested itself to Molière on the occasion of a visit to the Papal Nuncio where he saw the pious and solemn countenances of the Nuncio's courtiers suddenly lighted up with ecstatic animation by the appearance of a seller of truffles—in Italian, *tartufo*. The play was written in 1664, presented once in 1667, then prohibited, and it was not until 1669 that Molière succeeded finally in getting the king's consent, after which the comedy ran for three months.

**TARUDANT**, capital of the province of Sus, Morocco, on the Sus R., 40 m. from the sea. It has manufactures of copper goods and leather. Iron, gold, silver, and copper are found in the district. Pop., about 35,000.

**TARUMA**, a tribe of Indians of Arawakan stock, formerly living on the Rio Negro, Brazil. They now inhabit the region around the Essequibo River, in the highlands of British Guiana.

**TARUMARI**, a large tribe of Indians of Piman stock, dwelling in the Sierra Madre region of central and south Chihuahua, and adjoining border sections of Mexico. They were finally subdued by the Spaniards in 1692.

**TARWEED.** See **GRINDELIA**.

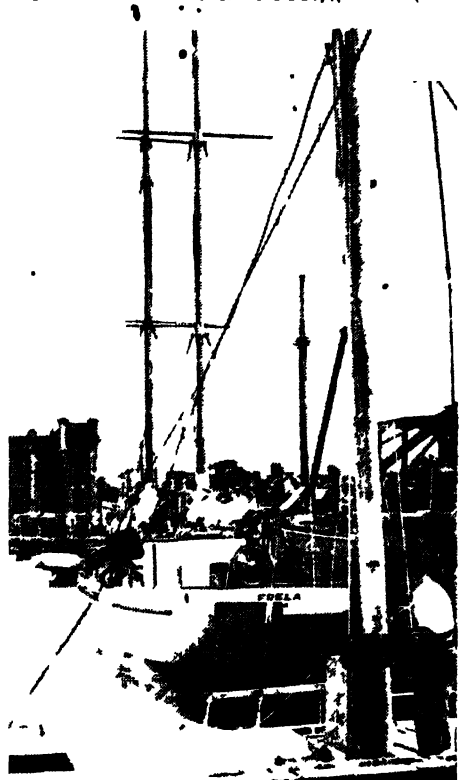
**TASCHEREAU, ELZÉAR ALEXANDRE** (1820-98), Canadian prelate, born in Ste. Marie de la Beauce, Quebec. He was educated at the Quebec Seminary, with which, after his ordination to the priesthood in 1842, he remained connected for nearly thirty years, first as professor of moral philosophy and from 1860 as superior, the appointment

including the rectorship of Laval University. In 1862 he was made vicar general of the diocese and archbishop in 1871. In 1872 he founded the Hotel Dieu du Sacre Cœur in Quebec and restored the church in Ste. Anne d'Beaupré. In 1886 he became cardinal, the first Canadian member of the Sacred College.

**TASCHEREAU, SIR HENRI ELIZAR** (1856-1909) Canadian jurist born in Ste. Marie de la Beauce province of Quebec and educated at Quebec Seminary. Called to the bar in 1878 he practiced his profession in Quebec City. He was a Conservative member of the Canadian legislative assembly, 1881-87, and in 1871 was appointed a judge of the Superior Court of the province. He was a judge of the Supreme Court of Canada, 1888-1900, and chief justice, 1893-1900. Continuing in the latter year, he was a member of the Judicial Committee of the Imperial Privy Council. In 1900 he was knighted.

**TASHKENT**, the capital of the Uzbek Soviet Socialist Republic in Soviet Central Asia, situated in an oasis north of Chirchik River, tributary of the Syr Darya R., about 100 miles N.E. of Samarkand. The city consists of a comparatively new Russian city with numerous public buildings and educational institutions, and the old Oriental city partly surrounded by walls with narrow crooked streets and low houses, so built because of earthquakes. Industries include sawmilling and the manufacture of cellulose machinery, tobacco products, and processed cotton. Agriculture and fruit growing are important in the surrounding area. The Tashkent population is mainly comprised of Russians, Sarts, Uzbeks, Tatars, and Kirghizes. The first verifiable historical mention of Tashkent dates from the 7th century A.D., although local traditions attribute greater antiquity to the city. Tashkent was captured by the Russians in 1865 and became the administrative center of Russian Turkestan. Population 555,000.

**TASMAN, ABEL JANSZON** (about 1605-59) Dutch explorer, born in IJutgeest near Groningen. He made two important voyages of discovery in the Pacific. In 1642 he left Batavia in command of an expedition sent out by Van Diemen, Governor General of the Dutch East India Company, to circumnavigate the Australian continent. During his voyage of ten months he discovered (Nov. 24, 1642) Tasmania which he called Van Diemen's Land, New Zealand, and the



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Films, built in Holland, Tasmania

Friendly and Timor Land. He made a second voyage in 1644 to New Guinea and New Holland and discovered the Gulf of Carpentaria.

**TASMAN GLACIER**, a glacier discovered in 1862 by Sir Julius von Haast, situated in the South Alps of the South Island of New Zealand. It is fed by the snows of Mt. Hochstetter and gives origin to the Tasman River.

**TASMANIA**, a State of the Australian Commonwealth, consisting of the island of that name and several small islands. Area including the island of Macquarie (80 square miles), 6,504 square miles; population (1951 est.) 114,600. The capital is Hobart, with a population including suburbs of (1951 est.) 57,120. Launceston with suburbs had a population (1951 est.) of 47,000.

Primary education is free, secular, and compulsory. Agriculture, stock raising, mining, manufacturing and lumbering are the chief industries. Wheat, oats, peas, hay, potatoes, fruits and hops are the chief crops.



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SCENES IN TASMANIA *Top Elizabeth Street, the main shopping center of the city of Hobart.*  
*Bottom: View of Port Arthur, in southeastern Tasmania*

Forests cover a large part of the island and the sawing of timber constitutes a major industry. Mineral products include copper, tin, silver, lead, osmiridium, coal, gold, and zinc. Manufactures consist mainly of wool, confectionery, paper pulp, and cement. Principal imports are food, tobacco, apparel, textiles, metals, and metal manufactures thereof. Exports include butter, cheese, fresh fruit, wool, zinc, timber, jams and jellies, and peas.

Executive power is vested in a governor, acting through a responsible ministry, and legislative power in a parliament of two houses, a Legislative Council and a House of Assembly.

**TASMANIAN DEVIL.** See **DASYURE.**

**TASSO, BERNARDO** (1493-1569), Italian poet, now chiefly remembered as the father of Torquato Tasso (qv). Born in Venice, he belonged to an illustrious family of Bergamo. Bernardo studied in Padua, where he gained the friendship of Cardinal Bembo, and, becoming secretary of Guido Rangone, was sent to France (1528). Here he entered the service of Renée, daughter of Louis XII of France. A few years later he entered the service of Sanseverino, Prince of Salerno, whom

he followed in many travels. The last years of his life were passed in the service of Duke Guglielmo Gonzaga of Mantua, who made him podestà of Ostiglia. His chief work, *L'Amadigi*, is now entirely forgotten.

**TASSO, TORQUATO** (1544-95), Italian epic poet of the Catholic reaction, son of Bernardo Tasso, born in Sorrento, near Naples. He was one of the greatest of Italian poets, though belonging to a time of decadence.

Tasso read Latin and Greek fluently at an early age, and composed both prose and verse in Italian. In 1560 he was sent to study law and philosophy at Padua, and while there composed and published his first work, a romantic poem in twelve cantos, *Rinaldo*, which he dedicated to Cardinal Luigi d'Este. In 1565 he entered the service of this cardinal, and by him was introduced to the court of his brother, Alfonso II d'Este, reigning Duke of Ferrara. The youthful poet was appreciated and encouraged by the sisters of the duke, Lucrezia, afterward Duchess of Urbino, and Leonora. In 1573 he published the *Aminata*, the most beautiful of pastoral dramas. His great epic poem, *La Gerusalemme Liberata*,



*The poet Tasso at Ferrara (from painting by Ferdinand Heilbuth)*

was not completed until 1574, when he submitted it before publication to the judgment of the distinguished savants and critics of the day. Their criticisms unhinged his highly strung mind. In 1579 he was confined by order of Duke Alfonso in the hospital of St. Anna in Ferrara, and there he remained a prisoner for seven years. During these years he produced many verses and philosophical dialogues, and a vigorous defense of his *Jerusalem*.

Duke Alfonso had been repeatedly petitioned to set Tasso free. At length in July, 1586, by the intercession of Prince Vincenzo Gonzaga, Tasso was liberated. He followed his new patron to Mantua, where he remained a year, and where he wrote a tragedy, *Torrismondo*. Thereafter he busied himself in rewriting his great epic, according to the modifications proposed by his numerous critics. The result was published under the name *Gerusalemme Conquistata* (Rome, 1593), and dedicated to Tasso's latest patron, Cardinal Cinzio Aldobrandini, nephew of Pope Clement VIII. By this pope he was summoned to Rome to be crowned on the Capitol as poet laureate. The ceremony, however, never took place, for on Tasso's arrival in the papal city he became sick and died.

**TASSONI, ALESSANDRO** (1565-1635), Italian critic and poet, born in Modena. He was secretary to Cardinal Ascanio Colonna (1599-1608), and subsequently entered the service of Charles Emmanuel, Duke of Savoy. His best-known work is the mock heroic poem *La Secchia Rapita* (written in 1614), which by reason of its choice diction and quaint humor ranks as an Italian classic. Among his other works are *Considerazioni Sopra il Petrarcha* (1609), a piece of criticism which created much controversy; *Pensieri Diversi* (1612); and the *Filippiche* (1615), which form a valuable historical document.

**TASTE.** The parts of the mouth affected by sapid substances are the surface and sides of the tongue, the roof of the mouth, and the entrance to the pharynx. The mucous membrane is invested by stratified squamous epithelium, which, over the surface of the tongue, covers little vascular projections termed papillae. In the cat tribe the papillae are hard and curved backward into the mouth, so that the animal can use the tongue as a scraper to remove the flesh from the bones of its prey. At the back of the tongue are some eight or ten papillae of quite a different nature, called "circumvallate". They are arranged to form a V with its angle

pointing backward. In the epithelium lining the trenches between the papillae are lodged little bodies called taste buds. Each taste bud looks like a flask-shaped barrel or box, the walls of which are composed of flat elongated epithelial cells fitted side by side like the staves of a cask. Each taste bud opens by a little pore into the trench, and a nerve enters into the deeper part. The impressions are carried by the nerve directly to the brain in either the fifth or the ninth cranial nerves.

Before the substance can stimulate the terminals it is necessary for its aromatic principles to be in solution. This is generally effected through the agency of the saliva. Four distinct gustatory qualities are appreciated by the sense of taste: sweetness, bitterness, acidity, and salinity. The intensity of the sensation of taste varies with (1) the area of the surface stimulated, (2) the concentration of the stimulant, (3) the length of the period of application, and (4) the temperature of the substance tasted.

**TATAR A.S.S.R.**, an autonomous soviet socialist republic of Soviet Russia, situated in the middle Volga region of e. central Russia. The principal rivers are the Volga and its tributary the Svyaga, and the Kama and its tributary the Vvatka. Agriculture is the chief occupation. The principal crop is rye; other crops are oats, flax, hemp, millet, buckwheat, lentils, corn, beets, and potatoes. The chief manufacturing industries, located in Kazan (q.v.), the capital, produce agricultural machinery, flour, leather, condensed milk, and textiles. Other manufactures include synthetic rubber, glass, bricks, typewriters, Tatar guitars, violins, carts and sleighs, and motion-picture film. Tatars comprise the largest element of the population; about 40% of the population consists of Great Russians. Russians outnumber the Tatars in the urban areas and the Tatars are in the majority in the rural regions. Educational facilities are poor and a high rate of illiteracy exists.

In the 10th century a Bulgarian kingdom flourished in the region, but in the 13th century a Tatar invasion ended the kingdom and Kazan was established as the capital of a Tatar khanate. In 1552 Czar Ivan the Terrible captured Kazan and ended the Tatar overlordship. The Tatar Autonomous Soviet Socialist Republic was created in 1920. Area, 25,907 sq.m.; pop., about 2,920,000.

**TATARS**, a term loosely applied to certain Tungusic tribes originally inhabiting Manchuria and Mongolia, and now represented



by the Fishshin Tatars of northern Manchuria, the Solons and Daurians of northeastern Mongolia, and the Manchus of China. In the course of the westward movement of the Mongols the term "Tatar" became popular among the civilized peoples of western Asia and eastern Europe and came to be applied with little discrimination. Ultimately it came to be used almost if not quite, as a synonym for Turkish, in which sense it is still employed by some modern ethnologists.

The "Tatars of Siberia" (Burabai, Itish, Tobol, etc.) are probably of very mixed origin. In western Siberia some fragments of the Ostriks, etc., have been styled Tatars, probably from their adoption of Tatar customs. The Tatars of European Russia are of diverse origin. The so-called Kizil and Astrakhan Tatars are fragments of the Golden Horde. The Tatars of the Crimea are probably composed of the Nogai Tatars of the steppes and the Tatars of the mountains and central region. There are also the Tatars of the Caucasus.

**TATE,** ALLEN (1857-1939). English manufacturer and art patron born in Chorley, Lancashire. In 1874 he went to London where he acquired a huge fortune in sugar refining. He was the principal founder of Liverpool University College. His chief claim to distinction however is as founder of the National Gallery of British Art, popularly known as the Tate Gallery, on the Thames Embankment near Vauxhall Bridge. This originated in his private collection of modern British pictures.

**TATE,** (JOHN ORFLEX) ALLEN (1857- ) American poet, literary critic and biographer born in Winchester, Kentucky and educated at Vanderbilt University, Nashville, Tennessee. In 1922, he obtained an editorial post on a literary periodical, *The Fugitive*. In 1924 he married the novelist Caroline Gordon (1895- ), and devoted himself to freelance writing. He was a Guggenheim Fellow from 1928 to 1930, and was professor of English at the Women's College of the University of North Carolina from 1938 to 1939. In the last named year Tate was granted a three year resident fellowship in writing at Princeton University. He held the Chair of Poetry at the Library of Congress, Washington, D.C., from 1943 to 1944, and edited the *Sewanee Review*, a periodical of literary criticism, from 1944 to 1946. From 1946 to 1948 he was an editor for the publishing house of Henry Holt & Company, New York City. Tate's verse is characterized by perfect-



G. P. Putnam's Sons

Allen Tate (from a painting)

tion of form and by the deliberate use of archaic, archaic terms to achieve satirical effect. His criticism emphasizes traditional values in literature and morality. His notable work include (poetry) *Mr. Pope and Other Poems* (1915), *Poem 1925-1* (1932), *The Mediterranean and Other Poems* (1935), *Selected Poems* (1937), *The Winter Sea* (1944) and *Poem 1922-17* (1948). (criticism) *Rationalist Essays on Poetry and Ideas* (1936), *Rationalism in Madness* (1941), *The Language of Poetry* (1942), *On the Limits of Poetry* (1948) and *Forlorn Demon* (1953), (novel) *The Fathers* (1958) and (biography) *Stonewall Jackson* (1938), *Jefferson Davis* (1929) and *Robert F. Lee* (1952).

**TATE,** NATHAN (1652-1715). English poet, writer born in Dublin, Ireland and educated at Trinity College. He succeeded Shadwell as poet laureate in 1690. He died in the precincts of the Mint at Southwark, London, then a sanctuary for debtors. His name survives only from the metrical version of the Psalms, which he executed in conjunction with Nicholas Brady.

**TATE,** RALPH (1840-92), English geologist and paleontologist born in Alnwick and

educated at the Royal School of Mines. In 1861 he entered the Philosophical Institution or Belfast as a teacher of natural sciences. In 1867 he joined an expedition for the exploration of Nicaragua and Venezuela, and upon his return to England published a series of papers on the geology and palaeontology of those countries. Appointed professor of natural sciences at the University of Adelaide, South Australia, in 1875, he passed the remainder of his life in that country, where he was active in scientific research and helped to establish the Royal Society of South Australia. His works include several hundred papers and monographs, among them *Flora Belfastinensis* (1863), *New Yorkshire Lias* (1876), and *Handbook of the Flora of Extra-tropical South Australia* (1890).

**TATIAN** or (Lat.) **TATIANUS** (fl. about 170 A.D.), Christian apologist, born in Syria. He studied Greek philosophy as a Sophist, but about 150 A.D. went to Rome and was won to Christianity by Justin (q.v.), surnamed the Martyr, whose disciple he became. Shortly afterward Tatian wrote his first important work, the extant *Oratio ad Græcos*, an exposure of paganism as compared with the new "barbarian philosophy". After Justin's death (about 165 A.D.) Tatian returned to Syria, where he performed valuable services for the Church. He adopted heretical views, however, possibly before his departure from Rome, and became the leader of a group of ascetics known as the Encratites (q.v.), who, believing that all matter was evil, forbade marriage, the eating of meat, and the drinking of wine. Tatian is said to have used water instead of wine in the celebration of the Eucharist. Of his many writings, the *Diatessaron*, a gospel freely constructed out of the four known Gospels, maintained a place of importance in the Syrian Church for two hundred years; this work has been preserved in an Arabic version, first published in 1888 with a Latin translation.

**TATIUS**, **ACHILLES** (4th century A.D.), Greek rhetorician who lived in Alexandria. He was the author of the extant romance *Leucippe and Cleitophon*.

**TATIUS**, **TITUS**, in Roman legend, a king of the Sabines. He is said to have waged war against the Romans after the rape of the Sabine women, and, following a reconciliation, to have ruled over the two peoples jointly with Romulus, the founder of Rome. Upon Tatius' death Romulus became the sole ruler of the city.

**TATLER, THE**, a penny paper published in London by Sir Richard Steele, issued three times a week and running through 271 numbers, between April 12, 1709, and Jan. 2, 1711. Its original purpose was merely to describe events of the day, but with the contributions of Addison, which began in number 18, it gradually assumed a more didactic tone and eventually became a set of essays on various social and quasipolitical topics Steele wrote 188 of the papers and Addison 41. The remainder were mostly written in collaboration. The successor of the *Tatler* was the *Spectator*.

**TATRA MOUNTAINS**, the central range of the Carpathian Mts., and the highest mountains of the system. They cross northern Hungary and the frontier of Galicia.

**TATS** or **TATES**, an agricultural people of extreme western Iran and the Caspian region of the Caucasus. Although they may possess some Mongolian blood, they are not 'Tatars' either physically or linguistically. Some authorities class them with the Persian Tajiks (q.v.). Their number approximates 100,000. Their language is a dialect of Persian.

**TATTERSALL'S**, a famous English market for riding and carriage horses, at Knightsbridge, London. It was established in 1766 at Hyde Park Corner by Richard Tattersall, a groom to the Duke of Kingston. It consists of a large building in the center of which is a large court under a glass roof. At one time it was the center of all business relating to horse racing and betting throughout the country.

**TATTLER**, common name applied to any of the long-billed shore birds constituting the genus *Heteroscelus* of the Sandpiper family. The birds are so named from their loud, chattering call. They are found only on coasts bounding the Pacific Ocean and resemble other sandpipers (q.v.) in feeding and mating habits. When in flight, tattlers utter a high-pitched, melodious whistle. The principal species is *H. incanous*, the wandering tattler, about 11 inches long, which is found from British Columbia to Alaska during the summer, and in the Hawaiian Islands in winter. It is slate gray above, and is white marked with slate gray below. The name "tattler" is sometimes applied to other sandpipers, such as the willet and yellowlegs (qq.v.).

**TATTNALL**, **JOSIAH** (1795-1871), American naval officer, born in Bonaventure, near Savannah, Ga., and educated in England.

He entered the United States Navy in 1812. He served with the American naval officer Stephen Decatur in the Algerine War and became a lieutenant in 1818. In the Mexican War he fought at the capture of Veracruz, and led the attack upon the forts at Tuxpan, where he was wounded. In 1850 he became a captain, and in 1857 flag officer on the Asiatic station. In 1859, while on this station, he chartered the small river steamer *Toeywan* to take the American minister to Peking in order to ratify a treaty negotiated in the preceding year. When the American squadron arrived off the Peiho River, Tattall found there the French and British naval forces with their diplomatic representatives on board. The Chinese having refused permission for any foreign vessels to proceed, the British and French forces attacked the forts. Seeing that they were being worsted, and that the boats containing reinforcements could not stem the strong current at the stream, Tattall, in the *Toeywan*, declaring that "blood is thicker than water", towed the steamer up to the support of the badly pressed vessels. The phrase has become historic.

On the outbreak of the Civil War in 1861, Tattall resigned and became captain in the Confederate navy, charged with the defense of Georgia and South Carolina. In March, 1862, he was given command of the *Merimac* (*Virginia*) and the defenses of Virginia. He destroyed this vessel in order to escape capture, and was later court-martialed for this act, but acquitted. Tattall was unsuccessful in his defense of Savannah, and in January, 1865, was obliged to destroy his fleet. He was included among the officers surrendered to the Federal commander, General William Tecumseh Sherman, was paroled, and in 1866 removed with his family to Halifax. He returned in 1870 and was inspector of the port of Savannah until his death.

**TATTOOING**, the practice of decorating the surface of the body by introducing pigments under the skin. The process consists in pricking the skin with a sharp instrument and inserting the pigments, usually powdered charcoal in the punctures. The design appears in a deep blue color and is indelible. Other pigments have come into use in recent times. As a primitive mode of ornamentation, tattooing is widespread, its distribution as compared with the related custom of scarification being determined by the color of the skin. In general, light-



*Tattooed hand of native of Marquesas Islands*

skinned races tattoo, while dark-skinned peoples practice scarring. In Oceania the practice is especially developed among the Polynesians.

The original significance of tattooing is disputed. It has been held by some that it had a religious or social meaning, but the best evidence goes to show that it was at first purely ornamental in character. The patterns range from simple lines and dots to complex designs. Probably the fullest development of the custom among primitive peoples is in New Zealand, and the Marquesas Islands, though it is also much practiced in various parts of the East Indian archipelago. The tattooing of the natives in North and South America and in parts of the world other than those mentioned above is, as a rule, simple. In modern times and among higher races the Japanese have brought the art to its highest state of perfection. The practice is prevalent among sailors of all nationalities.

**TAUBER**, RICHARD, stage name of ERNST SEIFFERT (1892-1948), Austrian tenor, born in Linz, and trained in music at the Hoch Conservatory in Frankfurt on the Main. He made his operatic debut at the Municipal Opera House in Chemnitz, Saxony, in 1913 singing the role of Tamino in Wolfgang Amadeus Mozart's *The Magic Flute*. His immediate success won him a contract

with the President's opera. Subsequently he toured the Continent, appearing in the leading opera houses of all the principal cities and at the Mozart festivals in Salzburg and Munich. He also became widely known for his performances in the light operas of Franz Lehar and Johann Strauss. Tauber was first heard in the United States in 1931 in a series of recitals, and returned frequently in subsequent years. In 1940 he acquired British citizenship.

**TAU BETA PI ASSOCIATION**, a college honorary technical fraternity that was organized in Lehigh University, South Bethlehem, Pa., in 1885. It derives its name from the initials of three Greek words that form the secret motto of the association. The Tau Beta Pi bears the same relation to engineering and similar studies as the Phi Beta Kappa does to literary scholarship, and the Sigma Xi does to original research in science.

The object of the fraternity is to mark in a fitting manner those who have conferred honor upon their Alma Mater by a high grade of scholarship as undergraduates, or by their attainments as alumni, and to foster a spirit of liberal culture in the technical and scientific schools of America.

**TAUCHNITZ**, KARL CHRISTOPH TRAUGOTT (1761-1836), German printer and bookseller, born in Grossspardau, near Leipzig. In 1809 he began to issue editions of the Greek and Latin classics. He was the first to introduce (1816) stereotyping into Germany, and he also applied it to music. A nephew, CHRISTIAN BERNHARD, BARON VON TAUCHNITZ (1816-95), founded in 1837 a printing and publishing house in Leipzig. In 1841 he began his well-known collection of "British Authors", of which 2600 volumes appeared within the first fifty years.

**TAUERN**, a division of the eastern Alps, including the principal section of what was known to the ancients as the Noric Alps. It lies between the Drave and Mur rivers on the s. and the Enns on the n. and extends from Brenner Pass in eastern Tirol into n. Styria. The system consists of two main divisions, the Hohe (high) Tauern in the w., and the Niedere (low) Tauern in the e. The whole system has a length of about 150 m. and a width of 28 m. It is wholly of Archean formation, consisting chiefly of gneiss in the west and micaslata in the east, with some granite. The western or Hohe Tauern, as their name implies, are considerably higher and more rugged than the eastern. Their main range forms a sharp ridge with steep

sides rising above the snow line and carrying a large number of glaciers, from which numerous mountain torrents fall in cataracts down the steep valleys. The highest peak in the system is the Grossglockner, with an altitude of 12,461 feet.

**TAULER**, JOHANN (1300-61), German mystic, born in Strasbourg. At the age of fifteen he entered the Order of the Dominicans. When the "black death" visited Strasbourg in 1346, Tauler stuck to his post and comforted the people. Except for preaching tours into the Rhineland, where he came into contact with the Friends of God (q.v.), he remained in Strasbourg until his death. Tauler was an emotional yet practical mystic and left a large number of sermons full of evangelistic life. *The Book of Spiritual Poverty*, formerly ascribed to him, has been more recently regarded as a compilation.

**TAUNTON**, one of three county seats of Bristol Co., Mass., situated at the head of navigation on the Taunton R., 35 miles s. of Boston. It is served by a railroad and steamship lines, and is a leading manufacturing center and a shipping and distributing point for the surrounding agricultural area. Among the industrial establishments in the city are numerous stove foundries and factories manufacturing cotton textiles and textile machinery, marine engines, power drills and tools, silverware, Britannia ware, plastics, brick, leather specialties, electrical equipment, hardware, and patent medicines. Taunton is the site of a State hospital for the insane. Structures of interest in the city include a statue of Robert Treat Paine, a signer of the Declaration of Independence and a member of the Continental Congress, who was a resident of Taunton, and whose son, also Robert Treat Paine, the poet, was born there in 1773. Taunton was first settled in 1638 and incorporated in 1639. An ironworks, marking the beginning of Taunton's industrial development, was established there in 1656. Another important early industry was shipbuilding. Taunton was chartered as a city in 1864. One of the first municipally operated electric-lighting plants in the U.S. was established in Taunton in 1897. Pop. (1950) 40,109.

**TAUNTON**, county town of Somersetshire, England, 45 miles s.w. of Bristol. In the great hall of its castle, fitted up now as a museum, Judge Jeffreys opened the "Bloody Assize", hanging 134 and transporting 400 of the inhabitants of Taunton and the neighborhood who had accorded "King" Mon-

mouth an enthusiastic welcome (1685) Taunton has shirt, collar glove, and silk manufactures, and a large agricultural trade Pop (1951 prelim) 33,613

**TAUNUS**, a mountain range of w Germany, extending about 55 m in a N-E direction from the E bank of the Rhine near its confluence with the Main. It consists mainly of schists and quartzites and reaches its highest elevation 2886 ft in the N. It is steepest, however, in the SW where many crags are crowned with ruined castles. The higher portions of the range are forested and the lower slopes are covered with vineyards yielding some of the best of Rhinish wine. The range is famous for numerous mineral springs including those at Wiesbaden, Homburg and Nauheim.

**TAUPO**, the largest lake in New Zealand. It lies in the center of North Island and is drained by the Waikato. The area of the lake is 30 sq mi. There are numerous geysers and hot springs in the district.

**TAURUS** (from Latin *bull*) the constellation of the zodiac indicated symbolically as and pictorially by the four quarters of a bull. The constellation Taurus contains the two famous star groups known as the Pleiades and the Hyades in the latter of which is situated the brilliant red star Aldebaran, see STAR. It also contains the crab nebula so named from its crablike appearance.

**TAURUS, MOUNT.** See ALA DACH.

**TAUSEN**, HANS (1194-1561) Danish leader in the Reformation; born in Birkenfeld in Løn. From 1525 to 1527 he studied at Wittenberg under the German religious reformer Martin Luther and after his return to Denmark fearlessly preached the doctrines of the Reformation (qv). He met with antagonism from the clergy but was successful with the people. In 1537 he became professor of Hebrew at Copenhagen University and in 1541 Bishop of Ribe. In worship he employed Danish instead of Latin wrote hymns and pamphlets in Danish and translated part of the Bible. Tausen was the first and one of the foremost of Danish followers of Luther in able and powerful preacher and gifted as a poet and linguist.

**TAUSIG, KARI** (1841-71) German pianoforte virtuoso, born in Warsaw and trained by his father and by the Hungarian pianist and composer Franz Liszt. He became famous for technique and interpretive ability and won a world-wide reputation by the concert tours that occupied his short life.

He was connected with the musical life of Dresden (1859-60), Vienna (1862), and Berlin (1865). In the last-named city he founded a "Schule des Höheren Clavier-spiels", which he conducted until 1870. Of Tausig's composition and arrangements the great proportion are classical pianoforte works which he edited. He composed two *Etudes de Concert* (E2 and A5), *Ungarische Zigeunerweisen*, *Nouvelles Sonates de Vienne* and *Valses Caprices*.

**TAUSSIG, FRANK WILLIAM** (1859-1940), American political economist, born in St. Louis, Mo. He began to teach political economy at Harvard in 1887, serving as full professor from 1892 to 1935. Ranking high as a writer on economic questions, he was editor in chief of the *Quarterly Journal of Economics* (1897-1935). He was chairman of the United States Tariff Commission (1917-19). He was one of the original members of President Roosevelt's so-called brain trust. Among his publications are *The Tariff History of the United States* (1888), *Employment and Income* (1911), *Imports and Money Matters* (1913), *The Trade Tariff and Reciprocity* (1917) and *International Trade* (1927).

**TAUSSIG, JOSEPH KNIGHT** (1877-1947) American naval officer, born in Dresden, Germany of American parents and educated at the United States Naval Academy, Annapolis. He served as an ensign in the Spanish American War, commanded destroyers in World War I, and participated in a number of American naval operations. In addition to these of these was including the expedition to Nicaragua (1917). Taussig was assistant chief of naval operations (1935-36) and commandant of the Fifth Naval District (1938-41). In 1940 he predicted before a committee of the United States Senate the certainty of an eventual war between the United States and Japan. The Navy Department termed his remarks "poor judgment" and the following year retired him with the rank of rear admiral. Although he had reached the statutory retirement age of sixty-four, his retirement was viewed as a reprimand for his statements to the Senate committee. Two years later when the US was engaged in the war he had to resign. Taussig was recalled to active duty.

**TAUTOG**, or BLACK TROUT, a fish belonging to the *Wassie* family, found in the North American seas. It attains a weight of 12 or 14 lbs. Its color is black on the back and sides and the belly is whitish, each jaw

has a doubled row of strong conical teeth.

**TAVERNIER, JEAN BAPTISTE, BARON D'AUBOYNE** (1605-89), French traveler, born in Paris. His first journey to the East lasted from about the beginning of 1631 to the summer of 1633, by Constantinople to Persia (now Iran), thence by Aleppo and Malta to Italy. The second journey (1638-43) was from Marseilles to Alexandretta, across Syria to Ispahan, thence to Dacca, Agra, Surat, Goa, and Golconda; the third expedition (1643-49) was through Ispahan, much of Hindustan, Batavia, and Bantam, thence to Holland by the Cape and St. Helena; and in the fourth (1651-55), fifth (1657-62), and sixth (1663-68) expeditions many districts of Persia and India were visited, the outward route being generally by way of Syria and the Arabian Desert, and the return one by Asia Minor. Tavernier invariably traveled as a dealer in precious stones (see **DIAMOND**). His famous *Six Voyages* was published in 1676; the complementary *Recueil* was published in 1679.

**TAWILAH.** See **KISIM**.

**TAXATION** (from Lat. *taxare*, "to estimate", "to evaluate"), the system of compulsory contributions, usually monetary, levied by a government upon persons, corporations, and property, primarily for fiscal purposes, i.e., as a source of revenue to be used for governmental expenses and other public purposes. Taxation may, however, be employed for various economic and social objectives. It may serve as a method of developing an improved and well-balanced economy by fostering or curtailing certain forms of industrial and commercial activity, or it may be used to bring about social reforms through a redistribution of wealth. Economists generally draw a distinction between taxes and such other compulsory contributions to government as fines and similar penalties, which are imposed as punishments for violations of the law. Taxes are usually also distinguished from governmental fees, tolls, and special assessments, which are levied as payments for specific benefits provided by the government to the individual taxpayer; and from tariffs (see **TARIFF**), which furnish revenue from duties on imports and exports.

Some economists and political scientists believe that taxation should be limited to an absolute minimum, on the ground that governments consume revenue in excess of the value of their productive functions. They assert that production can best be carried

on by private enterprises unhampered by heavy tax burdens, and that therefore "the best tax is the smallest tax". At the opposite extreme are those economists who hold that government should act as the principal productive agent of the community; revenues furnished to a government functioning in this manner would be used for the benefit of the individual through the production and equitable distribution of an abundance of goods. A midway position between these two extremes is held by scholars who contend that taxation should be judged on the basis of the uses to which the revenues are put. They view taxes as justified when the benefits derived by the community as a whole outweigh the burden imposed upon the individual members of the community. Economists are generally agreed upon the principle that taxes must be limited to a reasonable share of the social income of the community; any form of taxation which drains off an excessive proportion of that income must inevitably result in grave harm to the economic life of the community. General agreement also exists on the principle of relative uniformity and equality of taxation. That system of taxation is regarded as ideal which distributes the tax burden in accordance with the ability of the individual to pay, thus apportioning equally among the members of the community the sacrifices in the form of taxes which are to be used for the common good. Moreover, taxes must be levied and tax revenues used for public purposes only; a tax levied upon the entire community for the benefit of a small segment is both morally unjust and economically unsound, as it almost invariably leads to maldistribution of wealth.

*Sources of Tax Revenues.* Revenues are secured from taxation by a wide variety of methods. Property-owners are generally taxed on the assessed valuation of their holdings. Taxes levied upon incomes (see **INCOME TAX**) may be based upon a fixed percentage for all incomes, or they may be progressive, i.e., the ratio of tax percentage to income may vary directly with the size of the income. A form of tax in wide usage in the United States is the retail sales tax, this type of tax is levied either upon all retail transactions or upon those involving certain specified commodities. In many countries a relatively heavy tax is placed upon the production and sale of luxury goods, such as furs, jewelry, cigarettes, and liquor (see **EXCISE**); and on luxury services, such as

motion pictures and other forms of entertainment. Other common forms of taxation include levies upon inheritances (see INHERITANCE TAX) and gifts, and those imposed upon employers and employees to provide a fund for various forms of social insurance (q.v.).

*Shifting and Incidence of Taxation.* An understanding of the term "shifting", as it is employed in reference to taxation, is essential to a clear comprehension of the operation of tax systems. The term denotes the process whereby a tax burden is transferred or "shifted" from the taxpayer who makes the payment directly to the government, to another taxpayer. A common instance of shifting is that which occurs when a manufacturing corporation, required to pay an excise tax on the production of a certain commodity raises the selling price of the commodity. In this example, the tax has been shifted from the producer to the consumer. A related process of shifting occurs when taxes are levied upon farmland, with a consequent rise in the price of farm produce. The term "incidence" of taxation is applied to the ultimate source of payment for a specific tax. Thus, in the first example noted above, the incidence of the tax falls upon the consumer of the taxed commodity. Taxes of which the incidence falls upon the actual remitter of payment to the government are termed "direct taxes"; taxes which are shifted from the remitter are termed "indirect taxes".

*Evolution of Taxation* The tax systems of ancient Greece and Rome were based almost exclusively upon the extortion of tribute from conquered peoples, from foreigners living within Greece and Rome, and from slaves. No account was taken of any of the principles which guide tax administration in modern democratic societies, such as uniformity and equality of taxation, and the ability to pay of those subject to taxation. This lack of any standard of equity in taxation was also true, though in somewhat modified fashion, in the feudal world (see FEUDALISM) of the Middle Ages. After the rise of democratic representative government in the 17th and 18th centuries, taxation was radically altered. Previously, the taxpayer had enjoyed little voice in government, and hence, had resisted taxation, force being often required to obtain the tax funds from the people. With the spread of suffrage, and the consequent extension to the populace of control over the expenditure

of tax revenues, force became almost entirely superfluous; the taxpayer was willing to co-operate in supporting a government in which he was represented. Without such co-operation the modern systems of taxation requiring the taxpayer to furnish detailed and accurate information regarding his income and property, could not succeed.

*Taxation in the United States.* The Constitution empowers the Federal government "to lay and collect taxes, duties, imposts, and excises, to pay the debts and provide for the common defence and general welfare". This power is explicitly limited by the admonition that "all duties, imposts, and excises shall be uniform throughout the United States". The authority of the States, as sovereign bodies, to levy taxes on persons and property within their jurisdiction, for the purpose of meeting State expenditures, is limited only by the Constitutional prohibition on the imposition by the States of any duties or imposts on imports and exports. The Congress has no power to tax the agencies and instrumentalities of the State governments, and no State may collect a tax on Federal property. Under State legislative enactments, municipalities are authorized to levy taxes for local purposes.

During the 1790's, the first decade following the formal establishment of the U.S. government, import duties (see TARIFFS IN THE UNITED STATES) and certain internal taxes, notably levies on land and slaves, furnished all Federal revenues. This policy, which was favored by the Federalists (see FEDERALIST PARTY) who were then in power, was altered after the election to the Presidency in 1801 of Thomas Jefferson, the leader of the anti-Federalists. From the time of Jefferson's election until the outbreak of the Civil War in 1861, except for the period of the War of 1812, all internal taxes were abolished, the Federal government relying solely on import duties. Numerous internal taxes were instituted during the Civil War, but all except the excises on tobacco and liquor were abandoned soon afterward. It was not until the early 20th century that internal revenue began to provide a large proportion of the Federal income. A tax was laid on corporate profits in 1909, and the first tax on incomes was imposed in 1913. During World War I, and particularly after the entry of the United States in 1917, a number of excise taxes were instituted, in addition to such innovations in U.S. history as inheritance taxes and excess profits taxes.

Of the wartime taxes the inheritance tax was the only one of importance to survive in the postwar period.

The next major change in the U.S. tax system occurred in the 1930's, in the first Presidential administration of Franklin D. Roosevelt. As a means of mitigating the effects of the prevailing economic depression, Congress in 1935 enacted the Social Security Act, under which employers and employees were required to contribute to a fund for unemployment, old-age, survivors, and other forms of social insurance; see SOCIETY. Revenues received by the Federal government under this law subsequently became one of the largest single items in the total of Federal budget receipts. In a recent year, Social Security tax revenues totaled about \$2,271,000,000 before the deduction of appropriations. The entry of the United States into World War II, in 1941, was followed by a substantial rise in the rates of all Federal taxes, particularly individual and corporate income taxes. The tax rates were lowered somewhat after the conclusion of hostilities in 1945, but were raised to a new high following the outbreak of the Korean war in 1950.

The tax revenues of the Federal government in a recent year, and their sources, were as follows. The total revenues were more than \$62,000,000,000. About \$30,715,000,000, or approximately fifty percent of the total, was derived from individual income taxes. About \$21,467,000,000, roughly thirty percent of the total, came from corporate incomes. Taxes on alcoholic beverages and on tobacco yielded about \$2,549,000,000 and \$1,565,000,000, respectively. Approximately \$833,000,000 was realized from estate and gift taxes, and manufacturers' excise taxes accounted for about \$2,300,000,000.

**TAXIDERMY**, the art of putting up or stuffing natural history specimens in the dried state. Care has to be taken not to stretch the skin or soil the plumage of birds or the hair and fur of mammals with blood or grease. The skull and certain wing and leg bones are left in their place to preserve as perfectly as possible the form of these parts. Arsenical soap or a mixture of arsenic and alum is largely used for preserving skins.

**TAXILA**, a famous city of ancient India, situated near the modern village of Dheri Shahan, on a stream called the Tabranala, in the district of Rawalpindi, in the Punjab. It was one of the most populous and wealthy of all the cities of India, and seat of an

important university famous for instruction in the medical sciences. It was the residence of the Indian patron of Buddhism Asoka (q.v.) while he was viceroy of the Punjab. The Sus or Abasis became its masters in 126 B.C., only to lose it at the beginning of the next century to Kanishka, King of the Kushans.

**TAXIS**, in biology. See TROPISM.

**TAXODIUM**, genus of valuable American trees of the Pine family, Conitaceae, embracing only two species, the red or bald cypress, *T. distichum*, the timber of which is used for building purposes and the Mexican cypress, *T. mucronatum*.

**TAXONOMY**, the science of the classification of plants. Probably the first scientific study of plants was the attempt at classification. Artificial classifications, beginning with the most ancient one into herbs, shrubs, and trees, and culminating in the Linnæan system in the middle of the 18th century, were at first necessary on account of lack of knowledge of the structure of plants. Such classifications simply catalogued and pigeonholed the rapidly accumulating material, in preparation for a classification based upon natural relationships. Natural systems have been evolving since the 18th century, and have been modified by every advance in morphological knowledge. See BOTANY, GEOGRAPHICAL DISTRIBUTION OF PLANTS.

**TAXUS**. See YLW.

**TAY**, river of Perthshire, Scotland, rising on Benluy, on the Argyllshire border, at an altitude of 2980 ft., and flowing to the North Sea. Its total length is 118 m. Its principal affluents are the Tummel, Isla, Almond, and Earn. It is valuable for salmon fishing. At Dundee the estuary is crossed by the Tay Bridge, over 2 m. long.

**TAYABAS**, province of the S.E. part of northern Luzon, Philippine Islands. In the S.E. it is prolonged into an isthmus that connects the two portions of Luzon; the peninsula of Tayabas projects from the S. coast. Grain is produced in the area, and manufactured products include cigar cases, hats, and fabrics. Area, 2334 sq. m.; pop., about 150,000.

**TAYLOR**, a borough of Lackawanna Co., Pa., situated on the N. shore of the Lackawanna R., 4 miles S.W. of Scranton. It is served by two railroads, and is a railroad and coal-mining center, with extensive anthracite-coal mines. Pop. (1950) 7176.



**TAYLOR**, a city of Williamson Co., Tex., situated 35 miles N.E. of Austin. It is served by two railroads, and is the shipping point and trading center of an agricultural area in which cotton, corn, oats, grains, pecans, peanuts, poultry, dairy products, vegetables, and fruits are produced. Taylor is an important cotton market, and contains one of the largest factories manufacturing bedding in the South. Other industrial establishments in the city include cotton gins, cottonseed-oil mills, meat-packing plants, a poultry-dressing plant, feed mills, a pecan-shelling plant, machine shops, and a garment factory. The city, founded in 1876 and incorporated in 1882, was named after General Zachary Taylor, hero of the Mexican War. Pop. (1950) 9071.

**TAYLOR**, ARTHUR SWAIN (1806-80), English toxicologist and medical jurist, born in Northfleet, Kent. He studied in the united hospitals of Guy and St. Thomas in 1823. In 1831 at Guy's Hospital he began the first English course of lectures on medical jurisprudence. In 1835 he became lecturer on chemistry at Guy's, and was professor of chemistry from 1850 to 1870. His *Manual of Medical Jurisprudence* (1844) and *The Principles and Practice of Jurisprudence* (1865) passed through many editions. He first drew attention to the great incentive for secret murder offered by life insurance, and to the possibility of arsenical poisoning from wall papers and fabrics. Among his numerous writings was a *Handbook on Poisons* (1848).

**TAYLOR**, BROOK (1685-1731), English mathematician, born in Edmonton, Middlesex. In 1715 he published his *Methodus Incrementorum Directa et Inversa*, the foundation of the calculus of finite differences. Other works were a *Treatise on Linear Perspective* (1719) and the posthumous *Contemplatio Philosophica*.

**TAYLOR**, CHARLES FAYLELL (1827-99), American orthopedic surgeon, born in Wiliston, Vt., and educated at the University of Vermont. Among his inventions are the Taylor splint for treatment of curvature of the spine and the long extension hip splint. He was the founder of the New York Orthopaedic Dispensary and Hospital.

**TAYLOR**, DAN (1738-1816), English theologian, born in Yorkshire. After having been for a year one of Wesley's preachers, he seceded. In 1763 he united with the General Baptists but in 1769 headed a secession from that body.

**TAYLOR**, EDWARD THOMPSON (1493-1871), American preacher, born in Richmond, Va. Being early left an orphan, he was befriended by a sea captain who trained him as a sailor. Ordained (1819) a minister of the Methodist Episcopal Church, he became a popular missionary, noted for his use of nautical imagery. "Father Taylor", as he was popularly called, accompanied the frigate *Macedonian* with supplies to the famine-stricken Irish (1827), and preached in Cork and Glasgow.

**TAYLOR**, FREDERICK WINSLOW (1856-1915), American efficiency engineer, born in Germantown, Pa. He devoted himself to organizing the management of manufacturing concerns, including the Bethlehem Steel, Cramp's Shipbuilding, and the Midvale Steel companies. Taylor was the originator of scientific management in business, which quickly grew to an important movement. He patented about one hundred inventions, and devised the Taylor-White process for treating high speed tools.

**TAYLOR**, GEORGE (1716-81), a signer of the Declaration of Independence, born in Ireland. He emigrated to America as a redemptioner in 1756, and, after serving a wealthy manufacturer as a clerk in Durham, Pa., succeeded to the business. He was a member of the Provincial Assembly from 1764 to 1770, and on July 20, 1776, was chosen a member of the Continental Congress. He served only a short time, retiring in March, 1777.

**TAYLOR**, HARRY (1862-1950), American soldier and engineer, born in Tilton, N.H., and educated at the U.S. Military Academy at West Point, N.Y. He was promoted through the grades, becoming brigadier general in 1917. During World War I he served in France as chief of engineers.

**TAYLOR**, SIR HENRY (1800-86), English poet, born in Durham. He was a clerk in the Colonial office for 48 years. In 1845 he published a small volume of lyrical poetry, and in 1847 *The Eve of the Conquest and Other Poems*.

**TAYLOR**, HENRY OSBORN (1856-1941), American scholar, born in New York City, and educated at Harvard. He was a frequent lecturer at leading universities. His works include *Treatise on Law of Private Corporations* (1884), *Ancient Ideals* (1900), *The Medieval Mind* (1911), *Deliverance* (1915), *Thought and Expression in the Sixteenth Century* (1920), *Human Values and Verities*



CBS Photo

Deems Taylor

(1928), *Fact—the Romance of Mind* (1932), and *A Historian's Creed* (1939).

**TAYLOR, ISAAC** (1787–1865), English writer, engraver, and inventor, born in Lavenham, Suffolk. He wrote the *Natural History of Enthusiasm* (1829), *The Natural History of Fanaticism* (1833), and *Ultimate Civilization* (1860).

**TAYLOR, ISAAC EBENEZER** (1812–89), American physician, born in Philadelphia, and educated at the University of Pennsylvania. In 1860 he organized the Bellevue Hospital Medical College. He suggested the hypodermic method of treatment by morphia and strychnia, and first used the speculum in diseases of women.

**TAYLOR, BARON ISIDORE JUSTIN SÉVERIN** (1789–1879), French antiquarian and artist. The son of an English-born French citizen, he was educated in Paris; he devoted his life chiefly to travel, though in 1838 he was appointed inspector general of fine arts. His life work is mainly embodied in a series of twenty-four folio volumes entitled *Voyages Pittoresques et Romantiques de l'Ancienne France*, the publication of which covered the entire period from 1820 to 1863, and engaged the services of such well-known

French artists as Jean Louis Géricault, Jean Auguste Ingres, and Eugène Emmanuel Viollet-le-Duc (qq.v.) besides Baron Taylor's own drawings. The art of lithographic illustration with the aid of the camera lucida was carried to the highest perfection, especially in the later volumes, and although the original plan of the work was never completed, its influence in stimulating interest in the national monuments of France, especially those of the Middle Ages, can hardly be over-estimated. Baron Taylor also prepared illustrated volumes of travel in Spain and Portugal (3 vols., 1826–32); Syria, Egypt, and Palestine (3 vols., 1835); Jerusalem (1841); and Switzerland and the Pyrenees (1843).

**TAYLOR, JAMES BAYARD** (1827–78), American poet, novelist, and traveler, born in Chester County, Pa. He was an apprentice to a printer (1842), but left his trade to journey on foot through Europe, describing his adventures in *Views Afoot* (1846). Later he was correspondent for the *New York Tribune* in California, Mexico, Egypt, Asia Minor, Syria, India, China, Japan, Greece, Sweden, and Russia. He was secretary of the American legation in St. Petersburg (1862–63), and minister to Germany (1878). In 1871 he published a translation of Goethe's *Faust*. His first volume of poems is *Ximena* (1844); he wrote also a number of novels and books of travel.

**TAYLOR, JEREMY** (1613–67), English prelate and author, born in Cambridge. He held several rectorships in England; was chaplain to the king; master of a school in Wales; and finally bishop of Down and Connor in Ireland (1660). His works include *Episcopacy Asserted* (1642), *Liberty of Prophesying* (1647), *Life of Christ* (1649), *Holy Living* (1649), *Holy Dying* (1652), and *Ductor Dubitantium* (1660).

**TAYLOR, JOHN** (1750–1824), American legislator and writer, born in Virginia. He served in the United States Senate, 1792–94, for two months in 1803, and from 1822 until his death. He wrote *Principles and Policy of the Government* (1814) and *Disunion Sentiment in Congress in 1794*.

**TAYLOR, JOHN** (1808–87), Mormon leader, born in Winthrop, England. He emigrated to Toronto, Canada, in 1832. Originally a Methodist, he was in 1836 converted to Mormonism, and became (1838) one of its twelve apostles. He was engaged for a series of years propagating the doctrines of that sect in Great Britain and

France. Later he established in New York *The Mormon*, and edited other Mormon publications. He was present at the assassination of Joseph Smith in Carthage, and was wounded in the affray. Succeeding Brigham Young as president (1877), he headed the section of the Mormon Church favorable to polygamy.

**TAYLOR, JOHN LOUIS** (1769–1829), American jurist, born in London, England. He removed to Fayetteville, N.C., and in 1798 was elected a judge of the Superior Court. He was chief justice of the Supreme Court, 1808–29.

**TAYLOR, (JOSEPH) DEEMS** (1885– ), American composer and music critic, born in New York City, and educated at New York University. In 1912 he was awarded the orchestral prize of the National Federation of Music Clubs for his symphonic poem *The Siren Song*. Two years later he wrote a cantata, *The Highwayman*, for a festival in commemoration of the death of the American composer, Edward A. MacDowell. Beginning in 1912 he was employed as a journalist, and in 1916 went to France as correspondent for the *New York Tribune*. Upon his return to America the following year, he became associate editor of *Collier's Weekly*, and in 1921 was appointed music critic of the *New York World*. During these years he composed several works for orchestra, including the suite *Through the Looking Glass* (1922) and the symphonic poem *Jurgen* (1925), the latter was commissioned by Walter Damrosch for the New York Symphony Society.

In 1925 Taylor resigned his post on the *World* to fulfill a commission by the Metropolitan Opera Company to write his first opera, *The King's Henchman* (libretto by the American poet Edna St. Vincent Millay); the opera was produced in 1927 with great success, and was performed fourteen times in three seasons, a record at the Metropolitan for an American opera. After serving for two years (1927–29) as editor of the magazine *Musical America*, Taylor composed a second opera, *Peter Ibbetson* (based on the novel by the English writer and artist George du Maurier), also commissioned by the Metropolitan Opera Company; it was received with enthusiastic acclaim by music critics and the general public at its première in 1931. He also wrote a suite for string quartet, *Lucrece* (1936); a third opera, *Ramuntcho* (1947); and numerous orchestral and choral works. His compositions have

been performed frequently in Europe as well as America. After 1933 Taylor appeared as a commentator and narrator on many radio programs. He was the author of *Of Men and Music* (1937), *The Well-Tempered Listener* (1940), and *Music to My Ears* (1949), and editor of *Music Lovers' Encyclopedia* (1939) and *A Treasury of Gilbert and Sullivan* (1941).

**TAYLOR, LAURETTE, nee COONEY** (1887–1946), American actress, born in New York City. She was married to Charles A. Taylor, and later to J. Hartley Manners. She made her debut on the stage while a child, and in 1909 appeared in New York in *The Devil*. In 1912 she achieved a great success as Luana in *The Bird of Paradise*. Miss Taylor became best known in the Irish comedy role of Peg in Manners' play, *Peg o' My Heart*, which ran more than 600 performances in New York, 1912–14, and later more than 500 in London. During the same period she appeared in a sketch by her husband called *Happiness*. She subsequently appeared in many shows, including *One Night in Rome* (1919), *The National Anthem* (1922), *Pierrot the Prodigal* (1925), *The Furies* (1928), *At Marian's* (1934), *Candida* (1938), *Outward Bound* (revival, 1938), and *The Glass Menagerie* (1944).

**TAYLOR, MYRON CHARLES** (1874– ), American lawyer and financial expert, born in Lyons, N.Y., and educated at Cornell University. He joined the U.S. Steel Corporation in 1927 and has since served this enterprise in various positions. He was a member of the Industrial Advisory Board, National Recovery Administration (1933–35). Taylor served as personal representative to the Vatican for Presidents Franklin D. Roosevelt (1939–45) and Harry S. Truman (1945–50).

**TAYLOR, NATHANIEL WILLIAM** (1786–1858), American Congregational clergyman, born in New Milford, Conn. He founded what later became Hartford Theological Seminary.

**TAYLOR, PHILIP MEADOWS** (1808–76). British administrator and novelist, born in Liverpool. His best-known novels are *Confessions of a Thug* (1839) and *Tippoo Sultan*. His *Story of My Life* appeared in 1877.

**TAYLOR, RICHARD** (1826–79), Confederate soldier, the son of Zachary Taylor, born in New Orleans, La. As brigadier general he fought under Stonewall Jackson in the Shenandoah valley campaign, and then in the Seven Days' Battles before Richmond. Subsequently he became major general, and was



Metropolitan Museum of Art

President Zachary Taylor

put in command of Louisiana, the western part of which he recovered for the Confederacy. On April 8, 1864, he defeated General Banks at Sabine Cross Roads, and captured 22 guns and about 2500 prisoners. On the following day, however, Taylor himself sustained a severe repulse at Pleasant Hill. On May 4, 1865, he surrendered to General Canby. He wrote *Destruction and Reconstruction* (1879).

**TAYLOR, ROWLAND** (d. 1555), English martyr, born in Rothbury, Northumberland. Cranmer, to whom he was domestic chaplain, gave him the rectory of Hadleigh in Suffolk (1544), and he subsequently became archdeacon of Exeter (1551) and a canon of Rochester. Under Queen Mary he was imprisoned as a heretic for more than a year in the King's Bench, and was burned near Hadleigh.

**TAYLOR, THOMAS** (1758–1835), English scholar, known as "the Platonist", born in London. His fifty works include translations of the hymns of Orpheus, and parts of the works of Plotinus, Proclus, Pausanias, Apuleius, Iamblichus, and Porphyry.

**TAYLOR, TOM** (1817–80), English journalist and playwright, born in Sunderland. After about 1846 he wrote or adapted upward of a hundred pieces for the stage, including *Our American Cousin*, *Stili Waters*

*Run Deep*, and *Twist Axe and Crown*. In 1874 he became editor of *Punch*.

**TAYLOR, ZACHARY** (1781–1850), twelfth President of the United States, born in Orange County, Va. His family removed to Kentucky, where Zachary worked on a plantation and received an elementary education. At the age of twenty-three Taylor entered the army and fought against the Indians in the Black Hawk and Seminole wars. In the Mexican War, as a major general, Taylor distinguished himself by capturing Matamoros, Monterey, and Victoria, and by defeating Santa Anna overwhelmingly near the Rio Grande.

Taylor was elected President on the Whig ticket in 1848. He died of bilious colic sixteen months after taking office. His administration was beset with the slavery controversy that followed the Mexican War.

**TAYLORVILLE**, county seat of Christian Co., Ill., situated on the Sangamon R., 80 miles N.E. of St. Louis, Mo. It is served by three railroads and contains railroad repair shops. Taylorville is the center and shipping point of an agricultural and coal mining area. Soybeans, hay, poultry, and dairy products are the principal agricultural products of the surrounding region. In addition to coal mining, the chief industries in Taylorville are the processing of soybeans, poultry and dairy products and the manufacture of sheet metal, tools, machine-shop products, bond and photographic paper, and greeting cards. The city was settled and incorporated in 1839. Pop. (1950) 9188.

**TAYRA**. See GRISON.

**TBILISI**, or TILIS, the capital of the Georgian Soviet Socialist Republic (q.v.), situated on both banks of the Dura R., about 340 m. by rail N.W. of Baku and 165 miles E. of the Black Sea. The town is built in a valley sheltered by the Caucasus Mts. Architecturally, Tbilisi presents a mixed appearance, with a well-built Russian quarter, including handsome public buildings and European shops, and a large Oriental quarter with narrow, crowded streets and bazaars. The city is noted for its ancient churches, including the 5th-century Cathedral of Zion and the 6th-century Church of St. David. Among its educational institutions are the Georgian State University and the Georgian Academy of Science. Tbilisi, at the S. end of the Georgian military road and situated on the Black Sea-Caspian Sea railway, is an important trading and distribution center. Its principal manufactures are felt, cotton

goods, woolens, carpets, leather products, oil, wine, and tobacco products. Its population is comprised of Georgians, Russians, and Armenians.

The city was founded in the 4th century, and a century later became the capital of Iberia, a kingdom of L. Georgia. Tbilisi suffered frequently during the succeeding centuries from raids by Byzantines, Persians, Seljuks, and tribes which descended from the Caucasus for plunder. In the 12th century it became the national capital of Georgia. It suffered its last great raid in 1795, when Persian troops invaded and looted it. After Russia annexed Georgia in 1801 the city became Russified. In 1917 Tbilisi was the site of the Georgian provisional government. Pop., about 519,000.

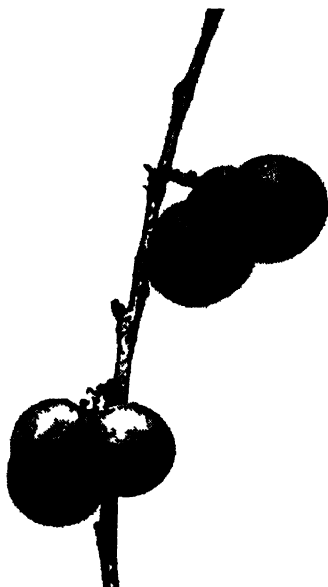
**TCHAIKOVSKY, PETR ILICH** (1840-93) Russian composer born in Votkinsk in the western Ural area and trained at the St. Petersburg (now the Leningrad) Conservatory. He studied under the Russian composer and pianist Anton Rubinstein from whom he subsequently took advanced instruction in orchestration. In 1866 the music teacher and composer Nicholas Rubinstein (1835-81) Anton's brother obtained for Tchaikovsky the post of teacher of harmony at the Moscow Conservatory. There the young composer met the dramatist Alexander Nikolayevitch Ostrovski who furnished him with the libretto for his first opera *Lovozoda* ("The Chieftain," 1868). Among his subsequent works are the operas *Eudine* (1869), *Mandragora* (unfinished, 1870), and *Oprishnik* (1872), the *Piano Concerto* in B flat major (1875), the symphonies no. 1 (called "Winter Dreams," 1868), no. 2 ("Little Russian," 1873), and no. 3 ("Polish," 1875), and the fantasy overture *Romeo and Juliet* (1870). The B flat piano concerto was dedicated originally to Nicholas Rubinstein who pronounced it unplayable. Deeply injured, Tchaikovsky made extensive alterations in the work and inscribed it to the German pianist Hans von Bulow, who rewarded the courtesy by performing the concerto on the occasion of his first concert tour of the United States (1875-76). Subsequently Rubinstein himself acknowledged the merit of the revised composition, and made it a part of his own repertoire.

In 1876, through correspondence, Tchaikovsky became acquainted with Madame Nadejda Filaretovna von Meck (1831-94), the affluent widow of a railroad contractor, whose enthusiasm for the composer's music



*Petr Ilch Tchaikovsky*

led her to settle upon him an annual allowance of six hundred pounds. Fourteen years later, however, believing herself to be financially ruined, Madame von Meck abruptly terminated the subsidy. Although Tchaikovsky's other sources of income were now inadequate to sustain him, his inordinately sensitive nature was deeply wounded by the sudden detection of his patroness without apparent cause, and he never forgave her. The period of his connection with Madame von Meck was one of rich productivity for the composer. To this time belong the operas *Lucien Olesin* (1878), *Ivan of Arc* (1879), *Mazepa* (1885), and *The Enchantress* (1887); the ballets *Swan Lake* (1876) and *Sleeping Beauty* (1889); the *Rococo Variations* for cello and orchestra (1876) and the *Violin Concerto* in D major (1878); the orchestral works *Marche Slave* (1870), *Francesca da Rimini* (1876), *Symphony no. 4* in E minor (1877), *Capriccio Italien* (1880), *Serenade* for string orchestra (1880), *Manfred* symphony (1885), *Symphony no. 5* in E minor (1888), and the fantasy overture *Hamlet* (1885), and a host of songs. Meanwhile, in 1877, Tchaikovsky had married Antonina Ivanovna Milyukov, a music student at the Moscow Conservatory who had written to the composer declaring her love for him. The union proved unhappy.



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Left A wild tea tree Right Fruit growing on the stem of a tea tree

from the outset, however and a separation was quickly effected

From 1887 to 1891 Tchaikovsky made a number of highly successful concert tours conducting his own works before large and enthusiastic audiences in the major cities of Europe and the United States. Early in 1893 the composer began work on his *Symphony no 6* in B minor to which the descriptive title *Pathétique* was subsequently applied by his brother Modeste. The first performance of the work given at St Petersburg on October 28th under the composer's direction, was indifferently received. Nine days later Tchaikovsky died of cholera. His other notable compositions include *Nutcracker* (ballt and suite 1891-92), the *Piano Concerto no 2* in G major (1880), the *String Quartet no 3* in E flat minor (1876), and the *Trio* in A minor for violin, cello, and piano (1882).

**TCHETCHEN.** See CHEH CHEN

**TCHITCHERIN, GEORGY V** (1872-1936), Soviet diplomat. He was educated under the Czarist regime but resigned in 1904 and left the country to live in western Europe, where he continued to maintain contact with the Russian revolutionary movement. After his return he was people's commissar for foreign affairs until 1930.

**TCHUVASHES,** a people of eastern Russia, probably of Finnic (Tcheremissian) origin,

and now with a strong Tatar admixture. Their seat is near the Volga and they number some 850,000. Their language is assigned to the Ural Altaic stock. They are industrious and orderly, their chief occupations being agriculture and cattle breeding. The Tchuvas are nominally Christians, but many still adhere to Shamanistic beliefs.

**TCZEW** (Ger *Dirschau*), commune of Gdansk Department, Poland situated on the Vistula R. 20 miles S of Danzig. Principal industries of Tczew include machine and railway carriage workshops and factories producing sugar agricultural implements, and cement. The town received municipal rights in 1260 and in 1308 came into the possession of the Teutonic Knights. By the second Peace of Thorn in 1466 between Poland and the Knights it became Polish. It was awarded to Prussia during the first partition of Poland in 1772 and was known as Dirschau until the reconstitution of Poland in 1919 when it was renamed Tczew. Some of the first battles of World War II, following the German invasion of Poland, were fought there during Sept., 1939. The Poles blew up two bridges across the Vistula at Tczew to halt the German advance, but the town was soon occupied. Pop., about 23,000.

**TEA,** common name applied to a family of trees and shrubs, to a species of shrub, *Thea sinensis*, within this family, and to the



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THE CEYLON TEA INDUSTRY Above: Young  
plants are taken from nurseries to be  
transplanted. Right: Loading chests of  
tea onto barge for transport to cargo  
ship. Below: Picking leaves in moun-  
tains. Tea is carried out by elephant.





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THE CEYLON TEA INDUSTRY. *Top, left: Green leaves are placed on racks and allowed to wither for 18 to 20 hours. Top, right: Machine which breaks up and sifts moist masses of leaves after they have been rolled. Bottom, left: Fermented tea being fed into a dryer. Bottom, right: Tea leaves are graded for size by machines, shown covered by dust extractors.*





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*Tea tasters grading teas in a laboratory. Taster can identify up to 1600 varieties*

beverage is made from its leaves. The Tea family, *Theaceae*, which contains 16 genera and about 175 species, is native chiefly to the tropical and subtropical regions of the world. Many species, especially those in the genera *Camellia* (qv) and *Gordonia* (cc Bax) are widely cultivated as ornamental shrubs in the United States. Members of the family have alternate leaves and large white, pink, or red flowers which are often solitary and sometimes double. The flowers have usually five sepals, five petals, numerous stamens, and a solitary pistil. The fruit is a septicidal capsule.

The typical genus of the Tea family is *Thea*, which contains about fourteen species native to the tropical and subtropical countries of Asia. The only important species in this genus is the common tea plant, *Thea sinensis*, the leaves of which have been used since prehistoric times in the preparation by infusion of a stimulating beverage. The active ingredient of this beverage, also called tea, is caffeine (qv). The common tea plant, which is probably native to China, is cultivated for its leaves in Japan, Formosa, India, and Ceylon; it is sometimes cultivated as a hedge plant in southern United States. The plant is an evergreen shrub or small tree, attaining a maximum height of about 30 feet. Under cultivation, however, the shrub is heavily pruned and kept at a height of no more than 5 feet; the tea leaves used in commerce are young leaves plucked from

new shoots. The large white flowers, which are usually solitary, range from 1 inch to 1 1/2 inches in diameter. The fruit is a dehiscent woody capsule containing three large seeds. Several varieties of the tea plant are grown in different parts of the world; the best known of these varieties are the bohea, *T. sinensis* var. *bohea*, Assam tea var. *assamica*, and Canton tea var. *cantonensis*. These plants are propagated from seed and yield their first crops of tea leaves after three years. The plants yield commercially valuable leaves for fifty years or more. Tea requires an extremely moist soil, growing best in regions having an annual rainfall of 90 to 200 inches.

Three kinds of tea are available on the commercial market: *black tea*, *green tea*, and *oolong tea*. These varieties of commercial tea do not correspond to the botanical varieties of the tea plant but are determined by the processing methods used on the leaves. The leaves of some varieties of tea are more easily processed into one type of tea than into another; for example, black tea is most readily made from the leaves of the bohea variety of tea.

Tea leaves contain a number of enzymes which cause them to ferment when crushed and exposed to air. In the preparation of black tea, the leaves are picked and allowed to dry in air for some time, after which they are rolled and crushed by hand or machine and again spread out in air, this time to

ferment. After fermentation, the leaves are rolled and dried by heat until crisp, and are then graded. The best grade of black tea, known as *orange pekoe*, is obtained from Ceylon and India. Other grades include *pekoe*, *congou*, and *souchong*. Green tea differs from black tea in being steamed after picking to inhibit the action of the fermenting enzymes. The grades of green teas include *pan-fired* and *basket-fired* green teas of Japan and *hyson* and *gunpowder* teas of China. Oolong tea is partially fermented and then steamed, and is therefore intermediate in characteristics between black and green tea; the best grade is *Formosa oolong*.

After being sorted, all grades of tea are packed in lead-lined chests to prevent absorption of unpleasant odors or loss of aroma during shipment. In China, tea is sometimes allowed to absorb the odors of various flowers such as jasmine. England and the British Dominions are the principal tea consumers of the world. Russia and the United States also import large quantities of tea. The United States imports slightly less than 100,000,000 pounds of tea each year.

The tea plant is attacked by several injurious insects, most important of which is the fagot worm (q.v.) The tea borer, which is the larva of a cossid moth, *Zeuzera coffeae*, attacks the stems and branches of the tea plant. Several species of scale insects (q.v.) in *Aspidiotus*, the genus containing the San Jose scale, attack the tea plant; *A. theae* is especially destructive to the young plant. Several mites also feed on the tea plant, including a red spider, *Tetranychus bimaculatus*, and the yellow tea mite, *Acarus translucens*, which destroys the buds.

**TEABERRY.** See GAULTHERIA.

**TEACH** or **THATCH**, EDWARD (d. 1718), Anglo-American pirate, popularly known as Blackbeard. He became widely known and feared for his robberies and atrocities throughout the West Indies and along the coast of the colonies of Carolina and Virginia. At Pasquotank, N.C., in 1718, he was attacked by two small sloops of the British navy; by a successful ruse Teach was led to board the vessels, and he with several of his men was killed.

**TEACHERS COLLEGE**, an institution in New York City for the training of teachers and school administrators, and for study and research in the field of education, founded in 1888, and made a part of the educational system of Columbia University in 1898. The college is an integral part of Columbia Uni-

versity and is represented by its dean and faculty delegates, but maintains its separate corporate organization, with a board of trustees who assume the entire financial responsibility for its maintenance. The departments of instruction are history and philosophy of education; educational administration, psychology and sociology; secondary, elementary, kindergarten, vocational, religious, and rural education; English, French, German, Greek, and Latin; history, biology, geography, and mathematics; household and industrial arts; music and speech; nursing and health; and physical education and science.

**TEACHERS' COLLEGES.** See TEACHER TRAINING.

**TEACHER TRAINING**, the systematic and specialized preparation of men and women to teach in elementary and secondary schools. Institutions offering formal instruction in the principles and practices of the teaching profession were unknown in ancient times and during the Middle Ages; the sole requirement expected of persons desiring to become teachers was the mastery of the subjects they desired to teach. Not until the rise during the 17th and 18th centuries of democratic theories and movements, with their fundamental assertion that the political, social, and economic development of nations could best be achieved through the education of the individual citizen by adequately trained teachers, were measures taken for the establishment of teacher-training institutions.

The earliest known institution to offer systematic training courses for prospective teachers was the Institute of the Brothers of the Christian Schools, established between 1680 and 1684 at Reims, France, by the French ecclesiastic and reformer Saint Jean Baptiste de la Salle (1651-1719). Another early training school for teachers was set up by the German educator August Hermann Francke (q.v.) at Halle in 1698. Both of these institutions were conducted without government support, however; the first government-sponsored teacher-training or normal school was founded in France by the Convention (see CONVENTION, NATIONAL) in 1794. This school was particularly notable in that it attempted to apply the basic theoretical principle, enunciated by the philosopher Jean Jacques Rousseau (q.v.), that educators should concern themselves primarily with the mental and physical development of their pupils, and only secondarily with subject matter. This principle was subsequently adopted by the teacher-training

schools established in many countries, and became a basic doctrine of all educational theory; see *EDUCATION: Modern Education, Theory and Science*. The most important of the numerous educators who applied and developed Rousseau's pedagogical theories was the Swiss educational reformer Johann Heinrich Pestalozzi (q.v.), whose work was the basis of much educational experimentation in the 19th and 20th centuries.

In England, a rudimentary form of teacher training was inaugurated early in the 19th century by the National Society for Promoting the Education of the Poor in the Principles of the Church of England, and by the British and Foreign School Society, a Nonconformist organization. The system established by these societies was based on the instruction of younger pupils by older ones who had received training from regular teachers. By the middle of the 19th century, the necessity for the creation of facilities for the further training of these "pupil-teachers" became apparent, and the first teacher-training colleges were set up. The colleges later came under the sponsorship and control of the British government.

An important advance in teacher-training theories and methods was made in Prussia early in the 19th century, when the views of the educator Johann Friedrich Herbart (q.v.) were adopted and applied on a broad scale by the Prussian seminaries. Herbart advocated the study by prospective teachers of the psychological processes of learning, as an essential prerequisite to the formulation of proper educational programs based upon the aptitudes, abilities, and interests of students. The best teacher, in the Herbartian view, is one trained to present knowledge in a form and by methods carefully adjusted to ensure maximum assimilation by the students. The success of the Herbartian method in improving educational standards subsequently led to its adoption in the teacher-training systems of numerous countries.

The 20th century has witnessed the institution of formal teacher-training curricula, integrated into regular university courses, in almost all civilized countries. Teachers are almost invariably required to complete satisfactorily the prescribed training courses, and to undergo rigorous examination, before being licensed to pursue their chosen profession. The existence of such requirements for teachers has become, in recent years, an index of the educational standards attained by the various countries of the world.

*Teacher Training in the United States.* The need of instructing prospective school teachers in methods of education as well as in the subjects they are to teach was first recognized in the United States toward the end of the 18th century. A group of teachers in New York City banded themselves together in 1794 as the Society of Associated Teachers to discuss the problems of teaching and to establish the qualifications for teachers. In 1805 DeWitt Clinton, then mayor of New York City, initiated a Free School Society in New York City to provide education for poor children. This society undertook to train teachers for its schools, and organized a course of study lasting from six to eight weeks. The course was highly effective, and the society soon began to receive requests from neighboring towns for teachers. In 1823 a Congregational clergyman, the Reverend Samuel Read Hall (1795-1877), opened at Concord, Vt., the first full-time institution in America for the training of teachers. He taught his students, on the basis of his own experience, to conduct classes and maintain discipline. A compilation of his lectures, published in 1829 as *Lectures on School-keeping*, was the earliest professional-education textbook in the United States. The demand for the book was great, and it had a wide sale, the State of New York alone purchasing 10,000 copies.

Other educators began to urge on various State legislatures the establishment of seminaries for teachers, based upon the Herbartian system of seminaries, or normal schools, for the training of teachers that had been inaugurated in the kingdom of Prussia. Between 1830 and 1835 the newspapers of the United States gave widespread publicity to the Prussian state system of seminaries and the Herbartian teaching method, and the movement for organized teacher training steadily gained strength throughout America. In 1837 Massachusetts established the first State board of education in the country, with Horace Mann (q.v.) as its secretary; in the following year Massachusetts enacted the first normal-school law, and provided funds for the opening of three normal schools. The success of these schools, and the propaganda for them promulgated by Horace Mann and other New England leaders in education facilitated the adoption by New York State in 1844 of a bill authorizing the establishment of a normal school in Albany. Connecticut and Michigan followed with similar bills in 1849, and by 1875 most of the State



*The blue-winged teal*

legislatures had passed normal-school laws. As the free-public-school system in the United States expanded at the end of the 19th century, and especially as the number of enrollment of high schools increased, many normal schools lengthened their period of training and made their entrance requirements more rigid. This tendency in the normal schools led to the gradual development of teachers' colleges, granting regular college degrees and fitting their students to teach in high schools.

Teacher training differs considerably in the various States. Generally a high-school graduate who successfully completes a two-year course in a normal school or teachers' college receives a certificate to teach in elementary schools; if he completes a four-year course, he is certified to teach in secondary schools. In many States special classes are offered in the high-school curriculum to train teachers for rural elementary schools. In a recent year there were approximately 207 teachers' colleges and normal schools in the United States. About 70 private schools exist primarily for the training of teachers of physical education and of kindergarten and primary grades. Professional training in teaching is offered also in many regular colleges and universities, both State and private.

In the 20th century, largely under the influence of the American philosopher and educator John Dewey (q.v.), the study of methods of teaching has been recognized as a science of the same status as sociology. This recognition has led to the establishment in most universities of departments of education, which are concerned solely with

the scientific study of the subject. Their work has brought about a great improvement in the standards of the teaching profession and an extension of teacher training to include commercial, technical, and agricultural specialization. See EDUCATION; EDUCATION, ELEMENTARY; EDUCATION, NATIONAL SYSTEMS OF United States.

#### TEACHING OF THE TWELVE APOSTLES. See DIDACHE.

**TEAGUE**, a city of Freestone Co., Tex., situated 151 m. by rail N. of Houston. It contains railroad repair shops, and is the market and shipping point of a rich agricultural area yielding cotton, corn, peanuts, oats, fruits, garden truck, and livestock. In the vicinity are clay deposits. Among the industrial establishments in the city are cotton gins, a cotton compress, a chick hatchery, and factories manufacturing mattresses, garments, and bricks. Pop. (1950) 2925.

**TEAK**, common name applied to a tall deciduous timber tree, *Tectonia grandis*, belonging to the Vervain family, Verbenaceae. The tree, which attains a height of 80 to 100 feet, is native to India and the Malay archipelago, and is cultivated widely throughout the Philippine Islands and Java. The bluish to white flowers are arranged in terminal panicles, and consist of a five-cleft calyx, a five-lobed corolla, five to six stamens, and a solitary pistil. The fruit is a drupe. Because of its great durability and strength, teakwood is used throughout the world as lumber in shipbuilding. In the tropics, the wood is employed primarily for the construction of furniture, and as such has been known to resist the attacks of insects and the corrosive effects of weather for hundreds of years. Various substitutes for teak, which have been under extensive cultivation because of the increasing demand for hard woods, are loosely termed "traks". African teak, or African oak, *Oldfieldia africana*, is a hardwood tree belonging to the Spurge family, Euphorbiaceae. Other substitutes include the Australia teak, or Hill's teak, *Endiandra glauca*; and two South African species, *Strychnos atherstonei* and *Copaifera coleosperma*.

**TEAL**, one of a group of small, freshwater ducks, mostly in the genera *Nettion* and *Querquedula*. They are migratory, going to the tropics for the winter, and when in the United States are shy and silent, feeding chiefly at night on water plants, seeds, worms, and insects. They make their nests usually at some distance from water, and lay

greenish, or in some species cream-colored, eggs. Species of these two genera are known in all parts of the world. The commonest North American species is the green winged teal, *N. carolinense*. This fine bird is nearly the same as the common teal *N. crecca*, of the northern part of the Old World. About a dozen other species are found in Asia, Africa and South America, all favorites among gunners and epicures. The blue winged teal, *Q. discors*, represented in Europe by the garganey, is very abundant in many parts of North America. It is somewhat larger than the common teal. The head and neck are blackish with a large white crescent in front of the eye. The wing coverts are sky blue and the under parts are purplish gray with black spots. The cinnamon teal *Q. cyanoptera* is also blue winged but the general color is rich purplish chestnut and there is no white on the head. This is a South American duck also common west of the Rocky Mountains as far north as Oregon.

**TEANECK**, township of Bergen Co., N. J., situated 10.8 miles E. of Paterson. Teaneck primarily a residential community is crissed by a railroad and contains industrial establishments producing electrical equipment and chemicals. Pop. (1950) 33,700.

**TEAPOT DOME** See LATE ALBIAN BASIN.

**TEARS**, drops of salty solution secreted in constant stream by a lachrymal gland above each eye (qv), serving to keep the eye always moist and free from foreign particles. The secretion passes from the surface of the eyeball into a small opening at the inner corner of the eye and then enters the nasolachrymal duct leading to the nose. Tears are occasionally emitted from the lachrymal gland in amounts too great to be accommodated by the nasolachrymal ducts and overflow the eyelids.

**TEASEL** or **TEAZEL**, a genus of Old World plants of the family Dipsacaceae. This family consists of herbaceous and half-shrubby exogenous plants with opposite or whorled leaves and flowers in heads or whorls surrounded by a many leaved involucre. The only valuable species of the order is the tulle's teasel, or clothier's teasel, *D. ful-lonum*, a native of the south of Europe, naturalized in some parts of England. The heads are cut off when the plant is in flower, and are used in woolen factories and by tulleers and stocking makers for raising the nap on cloth.

**TEA TREE**, common name applied to two evergreen shrubs of Australia, *Leptospermum*

*scoparium* and *Melaleuca leucadendron*, belonging to the Myrtles family. The shrubs which are greatly resistant to salt water, wind, drought and frost are cultivated extensively in many seacoast areas of the United States as a binder for loamy, sandy soils. *I. scoparium* has large white to pink flowers characterized by broad short sepals, roundish petals and numerous stamens. It reaches a height of 12 feet. *M. leucadendron* commonly referred to as the swamp tea tree, bears creamy white pink or purple flowers and has a thick spongy bark. *Leucadendron* sometimes referred to as African tea tree, is a member of the Nightshade family. It bears purple flowers and grows in thickets throughout many parts of Africa.

**TECHE, BAYOU**, a navigable stream rising in St. Landry parish of Louisiana and flowing 180 miles SE. to the Atchafalaya Bayou some 10 miles SW. of Morgan City. A rich agricultural district extends along its banks. The Bayou was at one time the main outlet of the Red River.

**TECHNETIUM**, a rare metallic element of atomic number 43, atomic weight 98 and symbol *Tc*, formerly called rhenium after the district of Misunt in E. Prussia. Its existence was first reported in 1925 when it was thought to be the unknown *ekman-gium* (of the mangan group). It occurs in minute quantities combined with the element rhodium in such minerals as columbite, perovskite, gadolinite and teruggenite and can be detected only by spectrographic and radiochemical techniques, see Microanalysis. It is believed to have a very high melting point and is of technical value such as sodium technetate Na<sub>2</sub>TcO<sub>4</sub>. See article on most of the minerals mentioned above.

**TECHNICAL EDUCATION**, all in training that has for its object the direct preparation for a career or vocation. In common use the designation is applied to such instruction as bears directly upon the industrial arts. The field of such education ranges from instruction in the arts and sciences that underlie industrial practice in its broadest and most complex relations to the simple training in manipulation needed for the prosecution of some productive trade. This wide province naturally calls for numerous and widely divergent types of schools.

Technical schools may conveniently be divided into three classes: (1) Institutions of a collegiate or university grade, to which the titles engineering schools, institutes of tech-

nology, polytechnic institutes, and schools of applied sciences, are variously given, and which are devoted to instruction in advanced mathematics and science, and the theory and practice of industrial operations. (2) Schools in which the purpose is to prepare for practical work in some particular field of industry and which afford instruction in those branches of science and art that underlie its special problems. This class is represented by schools of weaving, dyeing, building, and machine construction and drafting. Evening continuation schools which afford instruction in science, art, and technical methods may also be considered in this group. (3) Trade school which supply a training in the practice of some productive trade. The function of the first type of school is to educate its students for managers and superintendents of industrial establishments, consulting and designing engineers and architects.

*Engineering Schools, Schools of Applied Science, and Institutes of Technology.* The earliest establishment of this type of school occurred in France and Germany. In France the École des Ponts et Chaussées, originally started in 1747 as a drawing school, was organized in 1760 for the training of engineers for the government service. In 1794 the celebrated École Polytechnique was founded primarily to fit men for the engineer and artillery corps of the French army.

Later in the century came the great development of pure science in the German universities, and following this came an era of equal activity in the field of applied science, which quickly resulted in the widespread establishment of polytechnics or *Technische Hochschulen*. Rivalry between the various states played a part in the spread of these schools, each striving to outdo the others in magnificence of buildings and completeness of equipment. These institutions, which often had their beginnings in secondary technical or trade schools, have now become foundations co-ordinate with the universities, requiring equal academic preparation for admission, and representing specialized courses in engineering, architecture, industrial chemistry, and agriculture.

The splendid Technische Hochschule in Charlottenburg, and similar institutions in Munich, Dresden, Darmstadt, Hanover, Cassel, Aachen, and Breslau are foremost examples of this class. Engineering schools of a high grade are maintained also by the governments of Austria, Italy, Switzerland, Sweden, and the U.S.S.R. Great Britain

awakened more slowly to the need of technical education than other European countries, the chief stimulus being interest aroused by the Exhibition of 1851. In 1881 a Royal Commission on Technical Instruction was appointed to investigate the entire subject. Among other results of this awakening was the foundation of the City and Guilds of London Institute, formed by a union of many of the wealthy corporations of the old London guilds. The scope of the Institute activities includes the support and management of three institutions and the support of several others in the city of London, and the direction of a system of examinations dealing with the work of technical classes throughout England and Wales, and represents a system that touches all the important phases of technical instruction with the single exception of the trade school.

The most important of the three schools established in London, the Central Institution of the City and Guilds of London Institute, a well-organized school of technology, now forms a part of the Imperial College of Science and Technology, and is recognized as a school of the University of London in the faculty of engineering. Courses are provided for training engineers, architects, industrial chemists, and technical teachers. Other schools of an advanced character and several university departments of applied science have come to the front in Great Britain, prominent among which are the University of Manchester, the Manchester School of Technology, the University of Birmingham, the University of Leeds, the University of Sheffield, Armstrong College, and a number of others. Schools of engineering are maintained at the University of Glasgow, the University of Edinburgh, University College of Dundee, and the Glasgow and West of Scotland Technical College.

In the United States the development of the school of technology has been exceedingly rapid, and has resulted in a type of institution that in some respects is the superior of anything to be found abroad. The Rensselaer Polytechnic Institute founded in 1824 by Stephen Van Rensselaer as a school of theoretical and applied science, was the first establishment in this field. The work of this school has been almost exclusively devoted to the training of civil engineers. In response to the growing demand for scientific instruction, the Sheffield Scientific School (1847) at Yale and the Lawrence Scientific School (1848) at Harvard were founded.

Most of the technical schools, however, date from the later years of the Civil War. In 1861, through the efforts of William B. Rogers, the charter of the Massachusetts Institute of Technology was granted, and in 1865 the first classes were organized.

The Worcester Polytechnic Institute was opened to students in 1867. This was the first school of technology in the United States to provide systematic instruction in workshop practice as an element of the course in mechanical engineering. In 1864 the first courses in the School of Mines, Columbia University, were organized, and from this have developed the several schools of applied science of that institution. In 1871 the Stevens Institute of Technology at Hoboken was opened. The beginnings of the Sibley College of Mechanical Engineering and the Mechanic Arts were made at Cornell University in 1872, and other courses in applied science were soon established there. In the next twenty years a large number of schools of the first rank were founded either as separate institutions or as departments of universities. Notable among those of the first kind are Purdue University, Lafayette, Ind.; Rose Polytechnic Institute, Terre Haute, Ind.; the Michigan School of Mines Houghton, Mich.; the Case School of Applied Science, Cleveland, Ohio; and the Armour Institute of Technology in Chicago, Ill.

Prominent among the second group are the engineering departments of Lehigh University, the Ohio State University, Washington University (St. Louis), and the universities of Michigan, Wisconsin, Minnesota, Pennsylvania, and California. The State land-grant colleges established under the Morrill Act of 1862 also gave a great impetus to the study of engineering and mechanic arts.

*Technical and Applied Art Schools and Continuation Schools.* All the types of this group of institutions have reached a high point of organization on the continent of Europe. Technical schools, in which to practical training in the methods of a special craft is added instruction in the scientific principles upon which they are based, appear in greatest numbers in Austria, Germany, and France. Some have been established by guilds or masters' societies, some by a union of manufacturers of a town or city wishing to improve the efficiency of their establishments, and others by action of the local authorities or by the government. A steady tendency toward government control and support is apparent in all the continental countries.

Prominent among schools of this type are the special schools for weaving and dyeing, of which frequent examples are found in various parts of Germany. The most famous institution of the kind is located at Krefeld, West Germany. In this model institution thorough study is made of the chemistry and technology of dyeing, and of the mechanism and pattern designing involved in weaving. The Advanced School of Weaving in Lyons, France, the School of Silk Weaving near Zurich, Switzerland, the School of Weaving and Dyeing at the University of Leeds, and the textile departments of the Manchester School of Technology and of the Bradford Technical College, are other examples of this type of school. In the United States similar schools are the textile and dyeing schools of the School of Industrial Art of the Pennsylvania Museum in Philadelphia and the textile schools in Lowell and New Bedford, Mass.

France has a very important and highly organized system of state schools for the training of foremen and superintendents in mechanical industries in Chalons, Aix, Angers, Cluny, and Lille. The courses are three years in length. The instruction, both practical and theoretical, given in these schools, has been of so thorough a character that the result in large part has been to train managers and mechanical engineers rather than foremen. Other technical schools of an advanced character in France are the Industrial Institute of the North of France, in Lille, and the Institution Livet, in Nantes, which is a private foundation. A school of a special type exists in Lyons, the École Martinière.

In the United States schools of applied art are not numerous, and in few cases is a training in the practical application of design attempted. Prominent among the institutions affording instruction in this field are the Cooper Union of New York City; the School of Industrial Art of the Pennsylvania Museum; Pratt Institute, Brooklyn, N.Y.; Drexel Institute, Philadelphia; the Maryland Institute, Baltimore; the Art Academy, Cincinnati; the Chicago Art Institute; the Rhode Island School of Design, Providence; and the Lowell School of Design, Boston.

The organization of evening industrial classes is carried to its highest point in Great Britain. In the United States such evening schools have rapidly assumed an important place.

**TECHNOCRACY**, a nonprofit, nonsectarian membership organization of American citizens, until 1930 the Technical Alliance of

North America, a research organization founded in New York City in 1920 by engineers, scientists, and economists. In 1933 the Technocracy group became incorporated under the laws of the State of New York and its later growth as a nationwide membership followed.

The social analysis of Technocracy is founded on what is described as "a new technique of mensuration", first devised and applied to the physical operation of a geographical area by Howard Scott. This technique of social analysis and operations is described as an engineering or technological method as contrasted to the political, economic, or social methods of the politician, businessman, or humanitarian. Technocracy is not a moral political philosophy but is the statistical mechanics of area operation.

The activities of Technocracy are of an educational nature; the organization conducts study classes among its members.

**TECK**, an ancient principality named from a castle on "the Teck", a limestone peak in the Swabian Alps, 20 miles s.e. of Stuttgart. Held by various families from the 11th century on, it passed in 1498 to the dukes of Württemberg. Princess Mary of Württemberg was married to the Prince of Wales and Duke of York (later George V) in 1893, and accordingly became Princess of Wales in 1902 and Queen of Great Britain in 1910.

**TECK**, ALEXANDER, PRINCE OF TECK and 1st EARL OF ATHLONE (1874- ), British soldier, born in Kensington Palace, London, the third son of the Duke of Teck and Princess Mary Adelaide, and a brother of Queen Mary, consort of George V. Educated at Eton and at the Royal Military College, Sandhurst, he became successively a captain in the Seventh Hussars and in the Royal Horse Guards, and later was brevetted lieutenant colonel in the Second Life Guards. He served in Matabeleland in 1896, in the South African War in 1899-1900, and in the European War in 1914-15, being mentioned in the dispatches in each. For services in the South African War he also gained the queen's medal with five clasps and was made a member of the Distinguished Service Order. He was governor-general of the Union of South Africa (1923-31). He was appointed governor of Windsor Castle (1931), chancellor of London University (1932), great master of Order of St. Michael and St. George (1936), and was governor-general of Canada (1940-46). He married in 1904 Princess Alice, daughter of the Duke of Albany and

granddaughter of Queen Victoria.

**TECUMSEH**, a village of Lenawee Co., Mich., situated on the Raisin R., about 5 miles s.w. of Detroit. It is served by two railroads and contains railroad shops. Tecumseh is the trading center of an agricultural area noted for the growing of celery. Industries in the village are the manufacture of refrigeration units and compressors, air-conditioning units, airplanes, foundry and machine shop products, brick and tile, sash and doors, macaroni, and noodles. Tecumseh was incorporated as a village in 1837. Pop. (1950) 4020.

**TECUMSEH**, county seat of Johnson Co., Nebr., situated on the Nemaha R., 48 miles s.e. of Lincoln. The city is served by rail and is the trading center and shipping point of an agricultural area in which grain, vegetables, fruit, livestock, and poultry are produced. Pop. (1950) 1930.

**TEDDER**, SIR ARTHUR WILLIAM, 1st BARON TIDDER OF GLINGFIN (1890- ), British aviation officer, born in Glenguin, Stirling shire, Scotland, and educated at Magdalene College, Cambridge University. At the outbreak of World War I Tedder received a commission in the British army, and subsequently served in France. In 1916 he was transferred to the Royal Flying Corps. He continued to serve in the aviation arm after the Armistice, and in 1919 was transferred to the Royal Air Force (created in 1918). Tedder later served in the Middle and Far East, and occupied several administrative positions in England. He was commander in chief of the RAF in the Far East from 1936 to 1938, was deputy commander in chief of the RAF in the Middle East in 1940, and a year later was made commander in chief. Tedder is credited with the effective co-ordination of British air and ground forces during the El Alamein offensive which helped drive the German forces from North Africa in World War II (qv). In July, 1942, he was promoted to the rank of air chief marshal and knighted in the same year. On Nov. 27, 1942, he was appointed vice chief of staff of the RAF, and on Feb. 11, 1943, Allied commander in chief of the Mediterranean air forces. In December of the latter year he was named deputy commander in chief of the Allied Expeditionary forces, under General Dwight Eisenhower, and in Oct., 1944, assumed in addition the post of chief of Allied air operations in W. Europe. In 1946 Tedder became chief of the air staff (a position which he held until 1950).



and was raised to the peerage. He was appointed chancellor of Cambridge University in 1950. In 1950-51 he represented Great Britain on the standing group of the Military Committee of the North Atlantic Treaty Organization. His works include *Air Power in War* (1945).

**TE DEUM**, a majestic Latin hymn of the Western Church so called from its first words. It is ascribed by some to St. Ambrose and St. Augustine and by others to Hilary of Arles. In its modern form it was used by Hincmar of Reims in the 9th century. The hymn consists of twenty-nine verses, the first twenty-one are uniform in the four latest versions current and it seems probable that verses one to ten were a Greek hymn of the 2nd century.

**TEES**, a river of North England rising in Cumberland and flowing into the North Sea 110 miles below Skipton. It is 80 miles in length and navigable for small vessels to Stockton.

**TEETH**, hard bodies in the mouth attached to the skeleton but not forming part of it and developed from the dermal tissue skin. A tooth consists of the enamel, the dentin, the enamel, the crown of the tooth, the dentin, which forms a sclerotic substance and the cementum in which the root is fixed. The enamel consists of fine prismatic cells in which the enamel proteoplasm has been replaced practically entirely by lime salt, rendering it very hard and resistant to wear. The dentin resembles bone but contains a vast number of fine canals or tubules containing the processes of cells lying in the central pulp cavity of the tooth. The cementum is a layer of very dense bone which gives attachment to a large number of fibers called Sharpey's fibers, which firmly fix the tooth in its socket. In the pulp cavity lie blood vessels, numerous nerves and many cells, the odontoblasts largely concerned in the development of the dentine.

The number of teeth thirty-two which characterizes man in the apex of the Old World, and the true ruminants is the average one of the mammals. The *incisors* or cutting teeth are situated in front and possess a single conical root of fang and a vertical crown bevelled behind so as to terminate in a sharp cutting edge. These teeth are especially fitted, as their name implies, for cutting the food. In man there are two of these incisors in each side of each jaw (in the premaxilla).

The *canines* (so called from their prominence in the dog) come next to the incisors. Their crown is rather conical than wedge-shaped, and their fang sinks more deeply into the jaw than in the case of the incisors. In all carnivorous animals they are largely developed being obviously formed for tearing the flesh of their prey. The *premolars* (known also as bicuspids and false molars) come next in order to the canines, they are smaller than the latter and their crown presents two pyramidal eminences.

The *true molars* (or multicuspid) are placed most posteriorly. They are remarkable for their comparatively great size, the square form of the upper surface on which are from three to five elevations or cusps and a rather short root which is divided into from two to five branches, each of which is bifurcated at its extremity. They appear first in the permanent set.

In the primary or milk dentition we have only twenty teeth, the twelve adult molars not being represented.

Diseases which affect the teeth and consist in a gradual and progressive disintegration of the tooth substance. The exciting cause consists in the decalcification of the tissues of the teeth by acids which are for the greater part generated in the mouth by fermentation. Many of the diseases of the teeth and gum might be prevented or greatly retarded by proper attention to the cleansing of these organs. The teeth should be brushed twice daily, in the morning and in the evening.

**TEETHING DENTITION**, the acquirement of teeth, peculiarly of their first teeth, by children from about their seventh month onward. The process may take place in strong children without any constitutional disturbance or ailment other than some local irritation or inflammation. Many of the infantile diseases once credited to teething are due to improper feeding and neglect of hygiene.

**TEFFT**, BENJAMIN FRANKLIN (1813-85), American educator, born in Floyd, Oneida Co., N.Y. After teaching for four years in the Maine Wesleyan Seminary he entered the Methodist Episcopal Church, and throughout a varied career held pastorates. He was professor of Greek and Hebrew in Indiana Asbury University (1841-46), and president of Genesee College, Lima, N.Y. (1851-54). He conducted the *Ladus Repository*, Cincinnati (1846-52), the *Northern New Yorker*,

Canandaigua (1852-54), and *The Northern Border*, Bangor, Me. (1873-78), besides being United States consul at Stockholm and acting minister to Sweden (1858-61). He wrote voluminously.

**TEGEA**, an ancient city in s.e. Arcadia, Greece. In the 6th and 5th centuries B.C. it was usually in league with Sparta and supplied many troops to the Spartan armies. Five hundred Tegeans fought at the battle of Thermopylae (q.v.) in 480 B.C., and three thousand at Plataea (q.v.) the following year. After the defeat of the Spartans at Leuctra (q.v.) in 371 B.C., Tegea became independent, but, joining the Achaean League in 222 B.C., was conquered by Rome with the rest of the confederacy in 146 B.C. It existed as a Greek city until 395 A.D., when it was sacked by the Goths under Alaric. The small village of Piali now occupies its site. Excavations have laid bare part of the city wall, and many small bronzes and terracotta objects have been unearthed. The most important ruins are those of the great temple of Athena Alea, built under the supervision of the famous sculptor Scopas (q.v.) after an earlier temple had been destroyed by fire about 395 B.C.

**TEGERNSEE**, a beautiful mountain lake,  $3\frac{1}{2}$  miles long, in the extreme south of Bavaria, 30 miles s.e. of Munich. It is a popular summer resort.

**TEGETMEIER**, WILLIAM BERNHARD (1816-1912), English naturalist, born in Colnbrook, Bucks. He devoted himself to the study of variation in animals, and worked with Darwin, who embodied some of Tegetmeier's conclusions in his *Origin and Variation*. He lectured for a time to the Zoological Society. His works include *The Poultry Book* (1870), *Pigeons* (1870), *Cranes* (1881), *Pheasants* (5th ed., 1910), and *The House Sparrow* (1899).

**TEGNÉR**, ESALAS (1782-1846), one of the most prominent of Swedish poets, born in Kyrkerud, in the province of Vermland. It was not until 1808 that he attracted any attention as a poet; but the stirring *Warsong for the Militia of Scania* made his name known, and the patriotic appeal, *Svea* (1811), made it famous. In the following year he was chosen professor of Greek. The best creations of his poetic genius all belong to a comparatively short period of time (1817-25)—*Song to the Sun* (1817), *Epilogue on the Degree Day at Lund* (1820), *The Candidate for Confirmation* (1820), and *Axel* (1821). *Frithiof's Saga* (1825), a cycle of

epics treating of old Scandinavian days, is his masterpiece. He is probably best known to the English-speaking world by Longfellow's translation, *The Children of the Lord's Supper*, which appeared in 1841. Tegnér's collected works were published in 1847-50 (7 vols., Stockholm), and again in 1882-85 (8 vols.).

**TEGUAN** or **TAGUAN**, one of the local names of a flying phalanger of New South Wales, *Petaurista volans*, which is black and about the size of the large Indian flying squirrels. It resembles the other flying phalangers in the possession of an effective parachute, and in its habits.

**TEGUCIGALPA** (Ind., "silver hills"), capital of the republic of Honduras, situated about 3200 ft. above sea level, on the Cholecteca R., 60 miles n.e. of the Gulf of Fonseca in the Pacific Ocean. The city is one of the two capitals on the American continent which is not served by a railroad (Asunción, Paraguay, being the other). Administratively, Tegucigalpa has been amalgamated with the suburb of Comayagüela (q.v.), with which it is connected by bridge. The city is in the center of an agricultural and gold and silver mining district. Tegucigalpa is the site of the National University. The chief buildings include a cathedral, a presidential palace, a place of justice, a National Theater, a mint, and the Bank of Honduras. The city was founded in the 16th century. During the 18th century, large quantities of gold, silver, and marble were mined and quarried, but the value of the minerals has declined in modern times. In 1880 the city became the capital of the republic, after having been co-capital with Comayagua (q.v.). Pop. (1950) 92,951.

**TEHERAN**, or **TEHRAN**, the capital and largest city of Iran (q.v.), situated on a sandy plateau, 3800 ft. above sea level, 70 miles s. of the Caspian Sea. To the n. of the city is the Shemran district, used for governmental and private summer residences; in the s. are the ruins of Rayy, birthplace of the famous caliph, Harun al-Raschid. The center of Teheran is a square, the Meidan Sepah, in which are the important government buildings. To the s. of the square is the old Ark, or fortified palace, of the shahs, containing, among other celebrated art and historical objects, the jeweled Peacock Throne of Persia. A new palace has been constructed in the w. part of the city. Among the educational facilities is Teheran University. Industrial establishments include factories for



Joseph Covello, from Black Star

*Rival political parties demonstrating on Ferdowsi Street in Teheran, Iran*

cotton spinning and the manufacture of tobacco products, cement, beet sugar, glass, and soap. The city was founded in the 12th century, but remained a small trading center until about 1788, when it was made the capital of Persia. After the establishment of the Kajar dynasty, in 1794, the city rose to importance. Under the present Pahlavi dynasty, Teheran has been modernized, industrialized, and considerably rebuilt. In 1943, during the World War II, it was the site of an important conference between the U.K., U.S., and U.S.S.R. (see TEHERAN CONFERENCE). Pop. (1949) 1,010,000.

**TEHERAN, or TEHRAN, CONFERENCE,** a conference concerning war strategy and postwar settlements between President Franklin D. Roosevelt of the United States, Prime Minister Winston Churchill of the United Kingdom, and Marshal Joseph Stalin of the Soviet Union, held at Teheran, Iran, from Nov. 28 to Dec. 1, 1943, during World War II. During the discussions, the three leaders and their aides formulated plans for

a concerted attack on w. Europe, then entirely German-held, and also stated their responsibility, following victory, of establishing an enduring peace and of setting up a world family of democratic nations. The aid of Iran to the Allied cause was recognized, and economic aid was promised that country for its resistance to threats by the Axis powers. The declaration concerning Iran, assuring the "independence, sovereignty, and territorial integrity" of the kingdom, was significant in view of the rivalry for dominance in that area between the U.K. and the USSR. See CAIRO CONFERENCE.

**TEHUANTEPEC,** an isthmus in Mexico, between the Pacific and the Gulf of Mexico. The soil is rich, forests are extensive and yield fustic and logwood, and there are large pasturages. Suggestions have frequently been made since the days of Cortes (1520) to construct here an inter-oceanic canal, and the American Eads proposed to build a ship railroad. The Tehuantepec National Railroad (189 m. long), connects the ports



of Puerto Mexico (Coatzacoalcas), on the Gulf of Mexico and Salina Cruz on the Pacific

**TEHUANTEPEC**, a town of Oaxaca, Mexico, 10 miles above the mouth of the river Tehuantepec, and 19 miles NW of Salina Cruz Pop, about 12,000

**TEHUANTEPEC WINDS**, winds blowing from the NE and NW on the west coasts of Mexico, Guatemala, and Nicaragua which resemble the mistral and boia of South Europe

**TEHUELCHÉ**, a general term for several different Patagonian tribes. There is evidence that the Tehuelches are immigrants from more northern portions of South America but their origin is doubtful. They occupy a relatively small territory between the Strait of Magellan and the Santa Cruz River. They are considered the tallest of human races. Accurate observations on this point are few but the average stature of male Tehuelches is about 1.75 meter (5'7 1/2 ft). They are also very brachycephalic in head form. In culture they are low.

**TEINDS**, in Scotland the tithes or tenths of the annual products of the earth which are appropriated to the maintenance of the clergy of the Established Church. The Teind Court which now forms a branch of the Court of Session has the power of increasing once every twenty years the stipends of ministers until the tithes of the parish are exhausted.

**TEJON SERIES**, a marine clastic strata of the Eocene period lying along the Pacific coast. It is 4000 feet thick in the middle part of the California coast range.

**TEJU, JACUARU**, or TECT, common name applied to any of three species of lizards constituting the genus *Tupinambis* of the family Iguanidae and inhabiting tropical America. The lizards which attain a total length of about 4 feet are usually black in color with white or yellow spots or bands crossing the back. The head is massive, about 6 inches in width in an adult specimen and is covered with large bony shields, the jaws are powerful and contain strong teeth. The teju is carnivorous, eating lizards, rats and small chickens. The heavy body is covered with small, square scales arranged in transverse arcs over the back and sides. The tail is long and slender making up more than half the total body length. In South America, tejus are hunted with dogs for their flesh. The common teju is *Tupinambis teguixin*.

**TEKAX**, a town in the State of Yucatan, Mexico, 47 miles N of Merida. Products include mahogany, dyewoods, and sisal hemp. Pop. about 24,000.

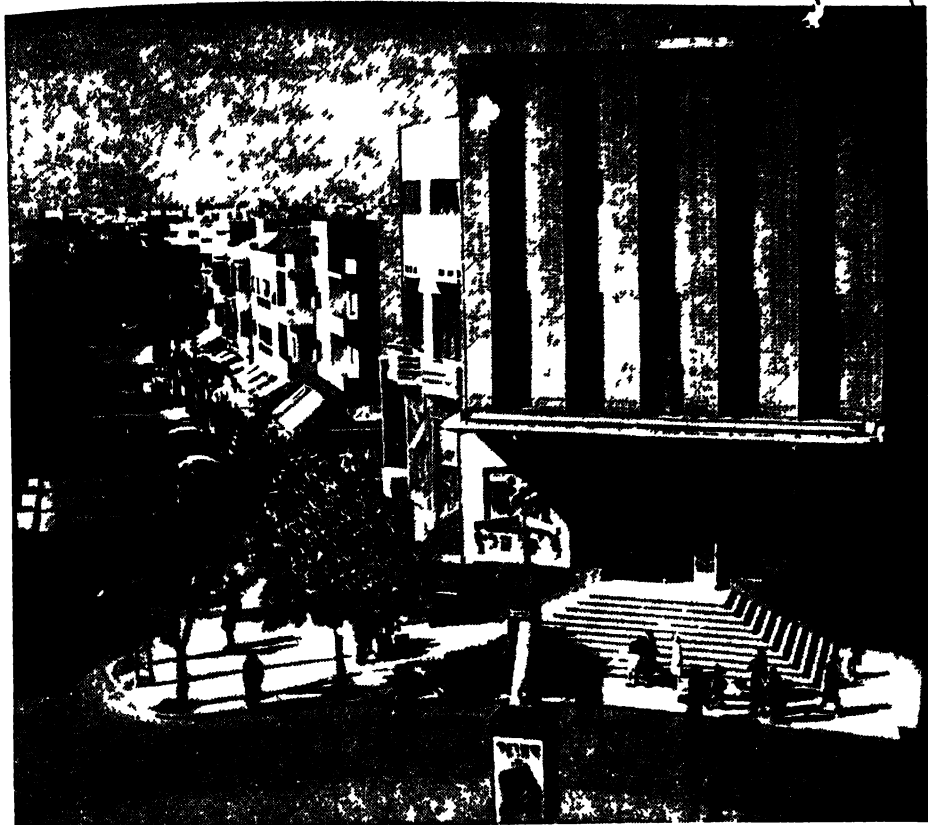
**TEKIYE**, a type of Mohammedan monastery inhabited by dervishes (qv) or other ascetics. The larger tekies are built about an arcaded court, beyond which are the chambers sometimes covered with domes. The smaller examples are often more ordinary houses. Well known examples are the tekies of the whirling dervishes at Pera, that of the howling dervishes at Scutari, and the one built near Damascus by Sultan Selim I in 1516.

**TELA**, a seaport of Honduras, situated on the Caribbean Sea on the republic's northern coast in the lowlands lying between the cities of Puerto Cortes and La Ceiba. The port which possesses a good harbor is the terminus of a network of light railroad and is a center of the banana trade. The United Fruit Company of the U.S. maintains a station there. In 1933 a large part of Tela was destroyed by fire. Pop. (1950) 12,599.

**TELAMON**, in Greek legend the son of Laertes king of Ithaca and the brother of Peleus (qv). Having assisted Peleus in murdering their half brother Phocus he was expelled from Ithaca by his father. He was received by the king of Salamis whose daughter Glauce he married. Telamon succeeded to the throne and by his second wife Periboe was the father of the famous warrior Ajax (qv). Telamon joined in the Calydonian hunt (see CALYDONIAN BOAR) and in the expedition of the Argonauts (qv) and was the first to scale the walls of Troy when that city was attacked by Hector. Upon the capture of the city Hector gave to Telamon as part of the spoils Helen (qv) the daughter of King Menelaus and by her Telamon was the father of Teucer (qv) who later fought against the Trojans with his half brother Ajax.

**TELAUTOGRAPH**, a writing or copying telegraph invented by Flisha Gray for reproducing writing or drawings at a distance by means of a receiving pen which directed by a complex mechanism that is under the control of electric currents follows the motions of a transmitting pen operated at the station of the sender.

An ordinary lead pencil is used near the point of which two silk cords are fastened at right angles to each other. These cords connect with the interior electrical mechanism, and, following the motions of the pencil



Tel Avivello from Black Star

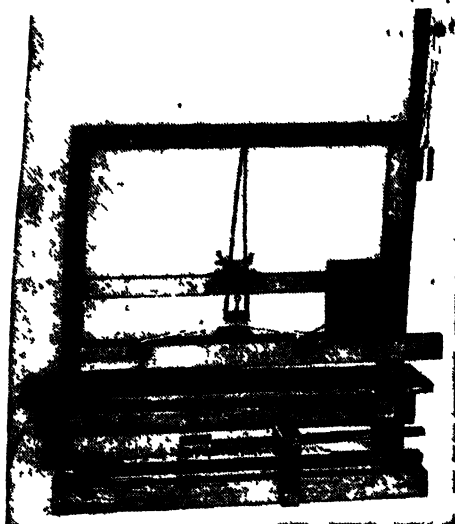
*Theater building, on Mograbiz Square in the city of Tel Aviv*

regulate the current impulses which control the receiving pen at the distant station. The writing is done on ordinary paper arranged on a roller. A lever at the left is so moved by the hand as to shift the paper forward mechanically at the transmitter and electrically at the receiver.

**TEL AVIV**, chief city and a seaport of Israel (qv), situated on the Mediterranean Sea. The city has wide avenues lined with trees and is almost entirely occupied by modern apartment houses. A broad beach and promenade fronts the Mediterranean. Tel Aviv is the center of Israeli cultural life. Its facilities include a municipal museum and music and art centers and many newspapers and periodicals are published there. Its population is almost entirely Jewish but because the majority are recent immigrants Tel Aviv is exceedingly cosmopolitan in languages, customs and folkways. The city is the center of a large and diversified indus-

try, including chiefly food, textile, and chemical manufacturing and the building trades. In 1931 the city established its own port (the facilities of Jaffa having been formerly used) at the mouth of the Yarkon River, consisting of a harbor basin 14,000 sq. meters in area.

Tel Aviv was founded in 1909 as a suburb of Jaffa on a sand dune S. of that city and was named in part by a loan from the Jewish National Fund. The city grew slowly and in 1916 during World War I was completely vacated by Turkey, then in control of Palestine because of the pro Allied sentiments of its inhabitants. After the anti-Jewish riots in Jaffa in 1921 (see PALESTINE) the Jews of Jaffa emigrated to Tel Aviv considerably increasing its population. By 1931 its citizens numbered 45,000, a number which increased to 145,000 in 1936 because of large scale immigrations of Jews from fascist controlled sections of Europe.



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*Left: Telegraph-recording instrument invented by Samuel F. B. Morse, completed in 1836 Above: Morse's improved telegraph-recording instrument of 1844*

During World War II Tel Aviv was raided several times by Axis planes, resulting in many casualties. In the war which followed the establishment of the state of Israel in 1948 the city, made the provisional capital, was bombed several times by Egyptian planes. In 1949 the Arab city of Jaffa was incorporated into Tel Aviv. Pop. (1951 est.) 370,000.

**TELEDU**, STINKING BADGER, or JAVANESE SKUNK, common name applied to a small, mustelid mammal, *Mydaus meliceps*, which lives in burrows in the mountains of Java, Borneo, and Sumatra. The animal is slightly smaller than the true badgers (qv), to which it is closely related. It differs from the true badgers in having a short tail, small ears, united toe pads, and a split upper lip. Its most conspicuous difference, however, is the skunklike elaboration and ejection of an offensively smelling fluid. In coloration, the teledu somewhat resembles the common American skunk, being blackish brown with a white or yellow stripe running longitudinally down the center of its back.

**TELEGONUS**, in Greek legend, the son of the hero Ulysses and the sorceress Circe (qv). Having been sent by his mother to Ithaca to find his father, he failed to recognize him when challenged by Ulysses as an armed stranger on his land, and mortally wounded Ulysses in the combat which ensued. Upon discovering his crime he assisted Penelope and Telemachus, the wife of Ulysses, and her son, in taking the body to Circe in Eëa. He subsequently married Penelope. The story of Telegonus is the theme of one

of the post-Homeric epics (see EPIC CYCLE). He was the reputed founder of the Italian cities of Tusculum and Præneste.

**TELEGONY**, the hypothesis that offspring inherit characters from a previous mate of the dam that bore them. See HEREDITY.

**TELEGRAPH**, any system of communication employing nonverbal electric signals which pass over wires. Originally any form of communication over long distances in which messages were transmitted by signs or sounds was called telegraphy. According to Polybius, a Greek historian of the 2nd century BC, ancient Greek telegraphers used torch signals in much the same way that modern Boy Scouts use semaphore flags. Various combinations of torches were used to represent the letters of the Greek alphabet; regular torch stations were set up throughout Greece. Similar manual systems of telegraphy were used during the Middle Ages and reached their culmination in the 18th century with the widespread use of the heliograph (qv) and of semaphore telegraphy. In semaphore telegraphy signals consisting of blades which could be arranged in different positions to represent letters were placed atop stone towers. One line of semaphore towers ran 1200 miles from Leningrad to the frontier of Prussia. Communication by this method was slow, particularly as each signal had to be repeated for verification before retransmission.

Attempts to use phenomena associated with electricity in communication began long before the nineteenth century. In 1558 the Italian physicist Giambattista della Porta

described a "sympathetic telegraph" which was to consist of two needles mounted on dials so that they pointed to the various letters of the alphabet in turning. Both needles were to be magnetized by rubbing with a lodestone, and it was thought that movement of one needle would cause similar movement of the other needle even though placed far away. The first practical suggestion for construction of an electric telegraph did not come until 1753. In that year a Scottish surgeon, Charles Morrison, wrote anonymously to the *Scots Magazine* suggesting an instrument which would employ electricity sent over wires for a great distance, with the earth completing the circuit between two points. Morrison advocated a cumbersome system in which many wires were to carry signals, one wire for each letter in the alphabet. The receiver at the other end of each wire was to consist of a pithball hung over a piece of paper marked with a letter of the alphabet. A charge sent to the ball by wire would attract the paper, and messages could be read by horizontal movement of the paper sheets. Systems of this type were actually built a few decades later, and in the years before 1835, when the American inventor Samuel Finley Breese Morse began developing his apparatus, other telegraphy techniques were tested.

Morse is credited with being the first man to invent a recording telegraph. His system employed a simple code in which messages were transmitted by electric pulses passing over a single wire; see MORSE CODE. Morse's apparatus, completed in 1836, resembled a simple electric switch. It allowed current to pass for a prescribed length of time and then shut it off, all at the pressure of a finger. The Morse telegraph receiver had an electromagnetically controlled pencil which made marks on a clockwork-operated cylinder of paper revolving beneath it. The marks varied with the duration of the electric current passing through the wires of the electric magnet and took the written form of dots and dashes. The pencil was so arranged that when current passed through the electromagnet it was attracted to the paper. The Morse receiver was the first practical means ever devised for recording incoming signals.

While experimenting with his instrument, Morse found that signals could be transmitted successfully for only twenty miles. Beyond that distance the signals grew too weak to be recorded. Morse and his associates therefore developed an apparatus called a

relay which could be attached to the telegraph line twenty miles from the signal station to repeat signals automatically and send them an additional twenty miles. The relay consisted of a switch operated by an electro-magnet. An impulse entering the magnet's coil caused an armature to rotate and close an independent circuit actuated by a battery. This action sent a fresh pulse of current into the line and in turn this pulse activated successive relays until the receiver was reached.

A few years after Morse developed his receiving instrument and demonstrated it successfully before the President of the United States, one of his associates, Alfred Vail, discovered that it was possible to distinguish dots and dashes by sound alone. The Morse recording apparatus therefore became unnecessary and was discarded. But the other fundamental principles of the Morse system are still used today in many telegraph circuits; and some devices for recording signals in modern times were patterned after the Morse recorder.

A simple Morse telegraph circuit as still used on some railroads in America and Europe consists essentially of the key or switch for turning current on and off and a connecting wire running between stations. The circuit is completed by return of current through the earth, thus making necessary the proper grounding of each end of the telegraph line. The receiving apparatus consists mainly of an electromagnet arranged so that when it is magnetized an armature is drawn with a click against an anvil. Batteries or generators supplying current for the signals may be located at each receiving station or the circuit may be arranged so that only the main station on the line has a direct source of current. In some systems the current flows constantly except when turned off for prescribed lengths of time by contact with the signal key, in others the current is turned on only during signalling.

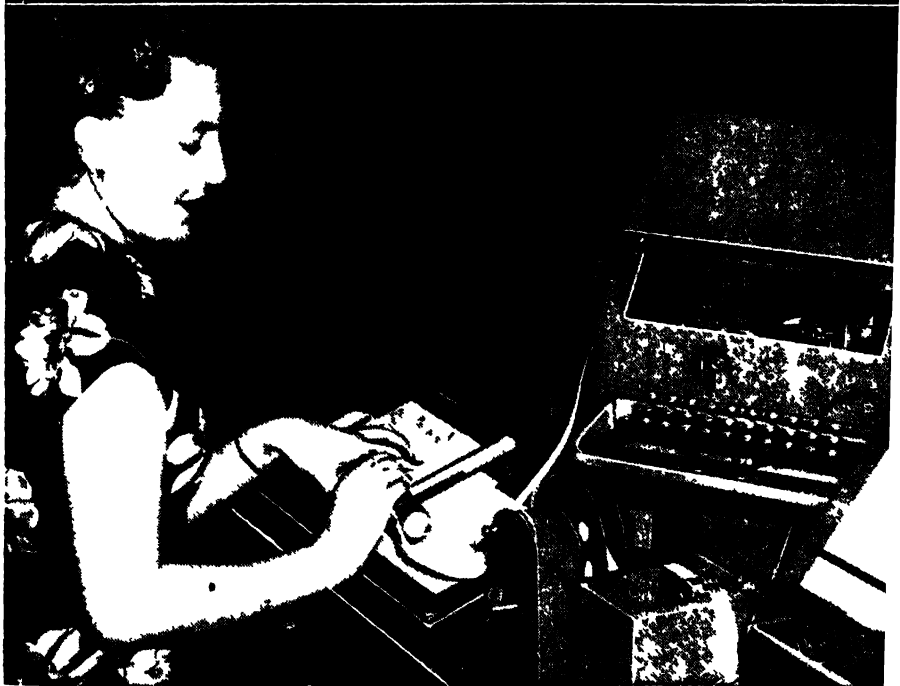
Early telegraphy was too expensive for widespread use, and so several means of sending several messages simultaneously over a single line were developed. In duplex telegraphy, the earliest advance of this kind, two stations could exchange single messages simultaneously. In quadruplex telegraphy, invented by Thomas Edison in 1874, two stations could exchange two messages simultaneously. In multiplex telegraphy, the system used today on lines between important stations where traffic is heavy, as many as



Western Union Telegraph Co

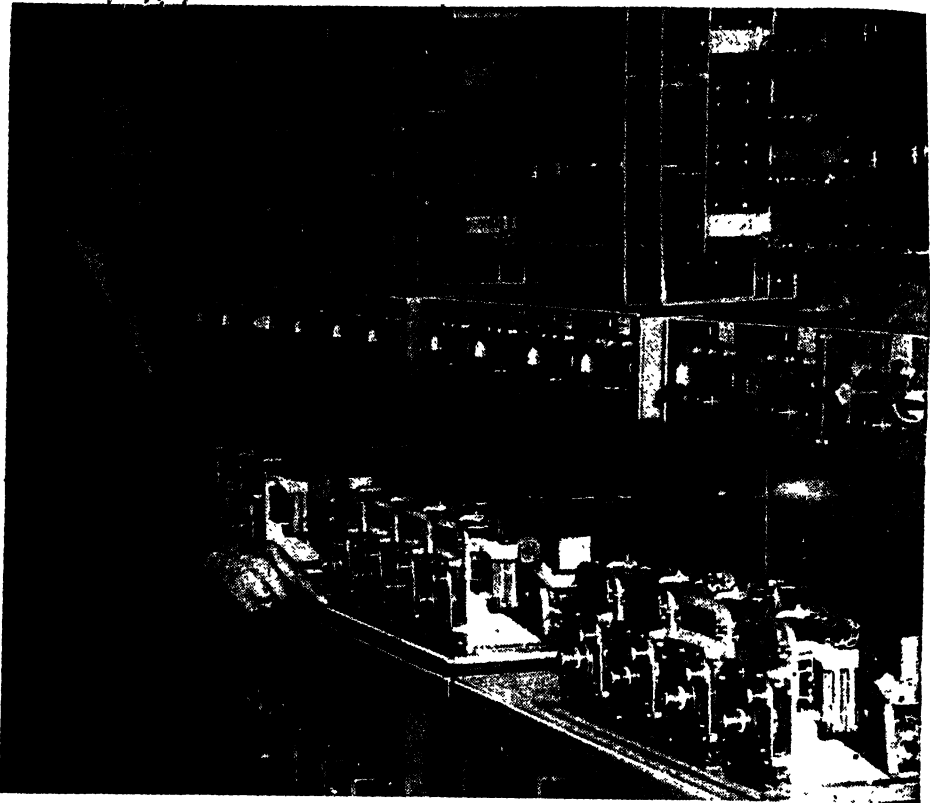
*Top: Telegraph operator typing a message on a recording transmitter, which sends signals in code. Bottom: Equipment in the message center of an automatic-telegraphy system.*





Western Union Telegraph Co

*Top At an automatic telegraph terminal a telegram is transmitted to office of delivery by push of a button Bottom Receiving message, printed on tape, at its destination*



Western Union Telegraph Co.



*Above: Mechanism in the high-speed switching center of an automatic-telegraphy system. Left: A transmission tower of a microwave radio-beam telegraph system. Approximately 2000 telegrams can be transmitted simultaneously from this station.*

four sending and four receiving telegraph machines can use a line at the same time.

**Automatic Telegraphy.** In commercial operation the simple, hand-operated telegraph key and sounder have been replaced almost entirely by automatic sending and receiving machinery, cutting costs by increasing the speed and accuracy of communication. Three common automatic-telegraphy systems exist: the "recording system", in which signals are sent and received on a recording device in code; the "facsimile system", in which an exact copy of the original message is reproduced just as it was written, drawn, or typed; and the "printing system", in which code signals are reproduced in a printed message at the receiver. Most recording-system transmitters are con-



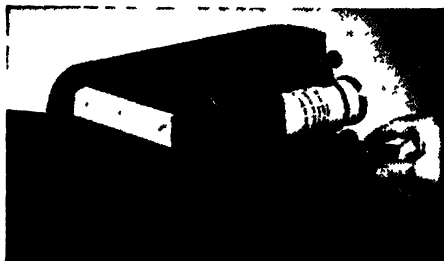
Western Union Telegraph Co.

*Above: Sending a message on a desk-type facsimile-telegraph instrument. An electric eye scans message as paper revolves on cylinder, and converts letters into electric impulses. Right: Message is received on an identical machine at destination by reversal of process.*

*A special, chemically-treated paper is used.*

trolled by a perforated tape, and send dot-and-dash signals. Special typewriters are used to prepare the perforated tape. These have keyboards similar to those of standard typewriters; the keys operate cutting devices which punch various patterns of perforations in the paper tape. The signal is generated by completion of a circuit, which occurs when the holes in the moving tape permit the contact of two metal surfaces. Recording-system receivers are modifications of Morse's original magnetic recording device, having a stylus or an inked wheel recording dots and dashes on a moving strip of paper. Recording-system equipment is used much less often, however, than other systems of automatic telegraphy.

Modern facsimile telegraphs are essentially like telephoto devices which are employed to send newspaper pictures over wires. The message or picture to be sent is placed on a slowly revolving cylinder. An electric eye in the machine scans the picture, one linear segment at a time, and controls the



transmission of current impulses which vary with the degree of shading in the exposed area. In turn this current controls operation of a receiver at the other end of the line, where a sheet of sensitized paper is darkened in a pattern corresponding, segment by segment, to the original Facsimile telegraphs are employed extensively for communication between branch telegraph offices and the main office and for transmission of messages from the headquarters of large firms to the main station of telegraph companies. In addition, private subscribers use facsimile devices small enough to be placed in a corner of a desk. Facsimile telegraphy greatly increases the speed of service by eliminating the need for messengers to carry telegraph messages to and from the subscriber's office. The bulk of telegraph messages, however, are still delivered by messengers who walk or ride bicycles to their destination.

\* In the printing system of automatic telegraphy, which is the system now most extensively used, the code used to control the transmitter differs from Morse dot-and-dash signaling. It is based on the thirty-one combinations possible with a five-unit series of impulses. As in the recording system described above, the transmitter is usually controlled by a specially perforated tape. The receiver used may type out the message on a sheet of paper in final form or on gummed strips of paper which are later pasted to a telegraph blank.

Some printing automatic telegraphs do away with tape control of the transmitting machine. Teleprinters as developed in the 1920's for the Western Union Telegraph Company are operated like typewriters. As the telegrapher strikes keys, the machine at another office to which it is connected writes the message out. Newspapers and other business offices use such machines for instantaneous reception of messages.

Signals traveling over a length of wire tend to weaken for various reasons. Among these are the line's inherent resistance to the flow of current and the tendency of current to leak from the line because of imperfect insulation. Signals are also distorted in form as they travel over the line, because of interference by various types of stray current which may be generated on the line by nearby power lines or other telegraph circuits. It is therefore necessary to divide a long telegraph circuit into sections. These sections can be connected together successively by devices called repeaters which receive signals from one section and pass them on to the next with renewed power. Modern repeaters not only repeat signals but also correct the form of the signal, restoring its original characteristics.

A single pair of wires can simultaneously transmit hundreds of messages, which are separated at the receiving end by electronic filters. One wire of each such pair serves as a "ground" and the other is activated by alternating currents, called carrier currents, of differing frequencies. For each frequency or "channel" there is a filter at the other end of the line which provides passage for only that frequency. As many as 288 messages can travel together in this way on a single pair of wires. Telegraph messages are frequently sent on wires simultaneously carrying spoken telephone conversations. Relatively high-frequency currents carry the telephone conversations while much lower

frequencies carry the telegraph message. A filter can be used at the end of the line to separate these frequencies and direct signal to either a telephone or a telegraph receiver. Most telegraph lines are strung on high wooden poles in rural and suburban areas and are carried by lines extended underground and sheathed in heavy insulation in cities.

All communications transmitted by telegraph can also be transmitted by wireless methods; see RADIO; FACSIMILE.

Almost all telegraphic messages in America are transmitted by the Western Union Telegraph Company. In a recent year the company had about 1,338,000 miles of wire in operation; approximately 16,200 offices handled about 180,000,000 revenue messages the same year.

**TELEGRAPH PLANT** (*Desmodium gyrans*), an Indian leguminous plant. Of its trifoliate leaves the lateral leaflets, which are small, have, especially in a warm, moist atmosphere, a strange spontaneous motion; they jerk up and down (sometimes 180 times in a minute), as if signaling, and also rotate on their axes.

**TEL-EL-AMARNA.** See ARCHAEOLOGY.

**TELEMACHUS**, in Greek legend, the son of the hero Ulysses and his wife Penelope (qv). Ulysses feigned madness to avoid going to Troy, but his stratagem was discovered when Palamedes (qv) placed the infant Telemachus in front of his father's plow. Telemachus plays a prominent part in the *Odyssey* of Homer, the scene of which is laid about twenty years after the close of the Trojan War. Under the guidance of the goddess Athena, he sets out in search of his father, who has not returned from Troy, after having vainly endeavored to eject his mother's troublesome suitors from the house. After visiting Pylos and Sparta, Telemachus returns to Ithaca, where he finds his father in the guise of a beggar and assists him in slaying the suitors. According to later legends, Telemachus married the sorceress Circe (qv), or one of her daughters, and was said to have founded Clusium in Etruria.

**TELEMACHUS** (fl. 5th cent. A.D.), Syrian monk who lived in Rome during the reign of the emperor Honorius. In 404 A.D., during a gladiatorial combat in the Colosseum, he leaped into the arena in a vain attempt to separate the contestants. He was stoned to death by the spectators, but his heroic protest is believed to have led the emperor to suppress gladiatorial fights.

**TELEMANN, GEORG PHILIP** (1681-1767), German composer, born in Magdeburg, Prussia, and educated at Magdeburg, Hildesheim, and Leipzig. At the University of Leipzig, Telemann organized a student music society soon after his matriculation in 1701. About this time, he wrote a number of operas for the Leipzig Theatre and undertook to produce a composition of ecclesiastical character for the Thomaskirche in Leipzig at biweekly intervals. In 1704 he received the post of organist in the Neukirche and became conductor of the private orchestra maintained by a wealthy nobleman at Sorau. Several years later he became orchestral conductor at Eisenach in Thuringia where he made the acquaintance of his illustrious competitor the composer Johann Sebastian Bach. Thereafter Telemann successively held the posts of music director of the Katharinenkirche in Frankfurt on the Main, choral conductor in the Barthskirche and church school conductor at the court of the Prince of Barchuth. From 1721 until his death he served as director (qv) of the Johannum and as music director at Hamburg. The numerous compositions of Telemann included the oratorios *Die Tugenden Des Aufrichtigen Christen*, *Der Tag Des Gerichts*, and *Der Tod Jesu*, about six hundred vocal and forty operas, twelve violin sonatas, six trios and six suites for violin, oboe and piano.

**TELEOLOGY**, the doctrine of final causes (see CAUSALITY), usually limited to the argument for a creator and for the existence of God derived from the existence, beauty and perfection of the world. See also THEISM, DYSMISOTHEOS, FINALISM.

**TELEOSAURUS**, genus of fossil crocodiles the remains of which occur in the Lower Jurassic rocks. Both surfaces of the vertebrae were slightly concave, the hind legs were large and strong and the anterior portion of the body gradually tapered into the long and slender jaws. The jaws were armed with numerous equal and slender teeth slightly recurved.

**TELEOSTEI**. See FISH.

**TELEPATHY**, word coined about 1856 from the Greek to express the supposed power of communication between one mind and another by means unknown to the ordinary sense organs. See PSYCHICAL RESEARCH.

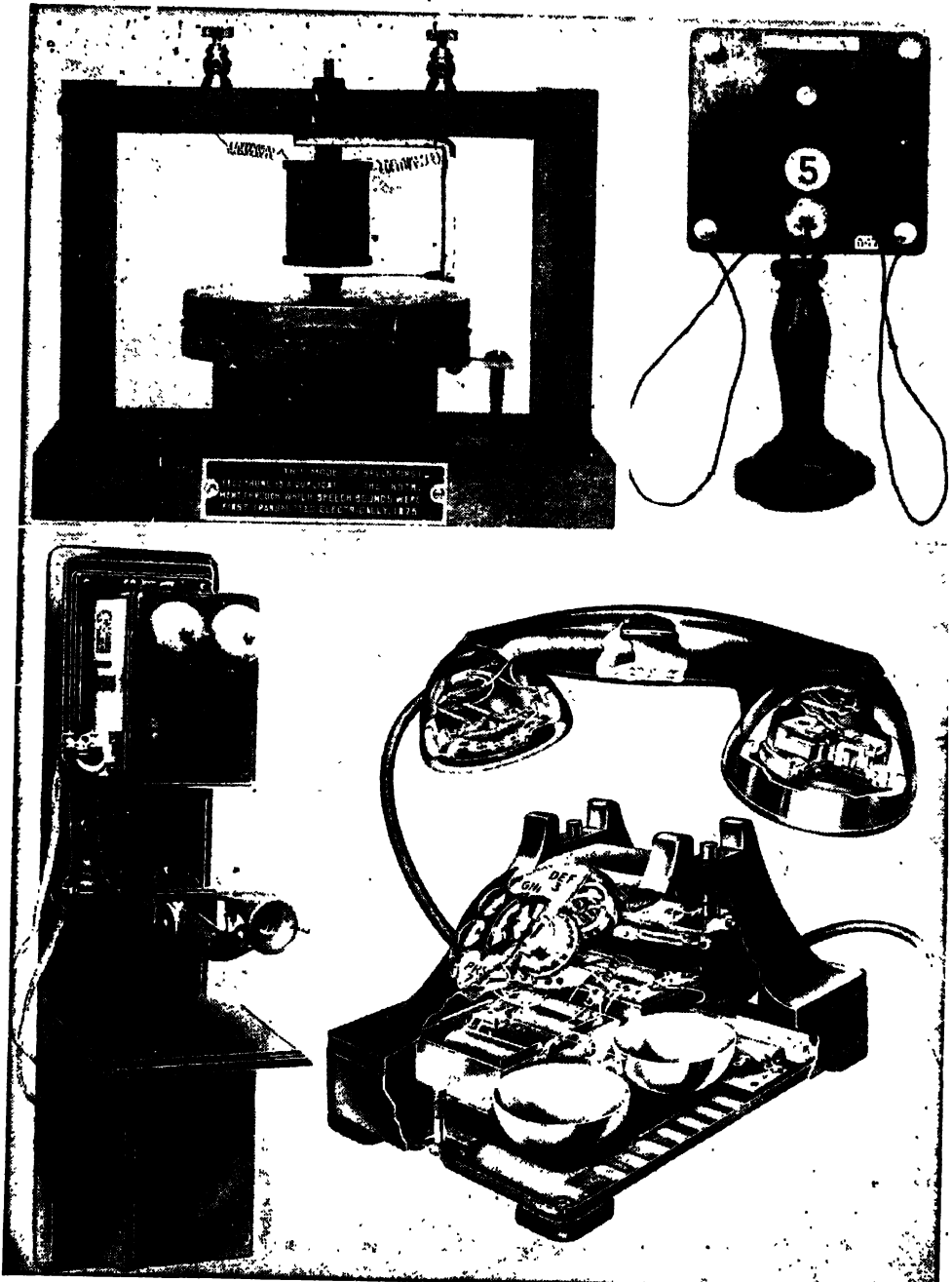
**TELEPHONE**, an instrument designed to reproduce sounds at a distance by means of electricity. A sounding body is always

vibrating, and the more rapid the vibrations the higher is the note produced. The problem of telephony is to reproduce in the receiver the same vibrations as the voice sets up in the transmitter.

**Early Forms**. In England in 1667 Robert Hooke conveyed sounds to a distance over an extended wire, but two hundred years passed before Wheatstone was able to transmit sounds from a musical box in a cellar to the upper rooms of a two story dwelling and this he did by means of an "enchanted lyre" or a wooden rod. These early experiments were acoustical telephones, the sound vibrations themselves being transmitted over the conductor.

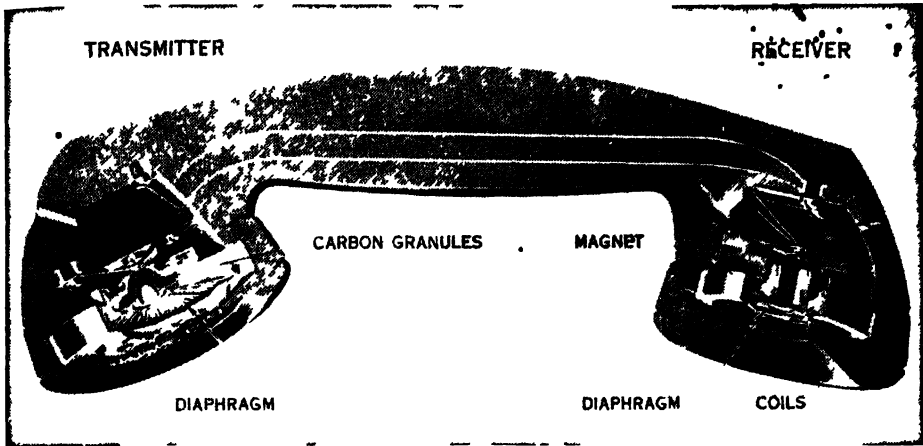
The first person able to indicate clearly the possibility of electric telephony was Charles Bourseul who in 1854 put forward the suggestion that the vibration imparted to a movable disk or diaphragm by speaking in front of it might be conveyed to make and break an electric circuit and thereby to produce similar vibrations in a second diaphragm elsewhere in the circuit and so reproduce the original sound. Six years later Reis of Frankfurt invented an instrument based on this suggestion, in which a colloidal membrane vibrating under the influence of the sound waves produced by the voice alternately made and broke a battery circuit. In 1876 an American inventor, Alexander Graham Bell was granted a patent for an electric speaking telephone and early in 1877 produced the first telephones to transmit and receive the human voice with all its quality and timbre.

**Bell's Magnetic Telephone**. No battery or other generator was used in the circuit, which consisted simply of a transmitter, a receiver, and a single connecting wire, the return circuit being made through ground. The transmitter and receiver were exactly similar instruments. Each contained a long horseshoe magnet supplied with soft iron pole pieces. Round about these were wound bobbins of fine wire, the two coils being joined together and their free ends being connected to the wires leading to the distant receiving station. In front of the pole pieces was a diaphragm of thin sheet iron which was secured firmly to its edge to the mouth piece frame. Adjustment between the diaphragm and pole pieces was by means of a thumb screw. When the sound waves produced by the voice impinge on the disk they cause it to vibrate in consonance with themselves. Further this vibration causes the



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**THE TELEPHONE, EARLY AND MODERN.** *Top, left: Model of the first telephone invented by Alexander Graham Bell, 1875. Top, right: Subscriber's-telephone set of 1878. Bottom, left: Long-distance wall-telephone set of 1886. Bottom, right: Cutaway drawing of a modern desk-type dial telephone. This complex instrument contains 433 parts made of 48 materials.*



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*Cross section of the handset of a modern desk type telephone*

center of the disk alternately to approach to and to recede from the magnet pole and thereby induces corresponding currents in the coils round the pole pieces. At the receiving station these currents act on the magnet field in the receiver strengthening or weakening it according to their direction and so increasing or diminishing its attraction on the disk with the result that the disk reproduces the vibrations of the disk in the transmitter and the original sound is reproduced.

**Circuits and Instruments.** The currents produced in Bell's magnetic circuit were very weak. It has been found that much better effects are produced by varying the strength of a current from a generator. All modern telephone circuits therefore with few exceptions include a *battery*.

Instruments of the Bell type are now mainly used as *receivers* only. In the modern Bell receiver itself the magnet is greatly shortened and the instrument is flattened down into the form of a watch. In the Adair receiver the magnetic field acting on the ferrotypic iron diaphragm is rendered more intense and more uniform by a ring of soft iron placed outside the diaphragm.

In actual practice the telephone *transmitter* consists of an outer case for protection. Behind a perforated grill is mounted a thin aluminum diaphragm radially corrugated. In the center is a dome about the size of a pea. Back of this and attached to the case is a brass cup. A pile of tissue paper rings forms a flexible seal between them. The enclosed space is filled with carbon granules highly

polished. When the dome which is part of the diaphragm is vibrated by speech waves from the grill the carbon granules are gently agitated varying the pressure. The increasing pressure decreases resistance hence increasing the flow of electric current through the granules and vice versa. Thus the speech waves modulate electric current into a copy of them live.

Since the unmodulated direct current carries no intelligence no useful purpose is served in transmitting it over the line. In early telephones direct current was battery generated. The local circuit included in addition to battery and transmitter one winding of a transformer called an *induction coil*, the other winding connected to the line. It was so proportioned as to step up the speech wave voltage before applying it to the telephone. Modern telephone receivers take the battery supply over the line from the central office but the induction coil remains to play much the same part.

The use of the *induction coil* with the transmitter dates back almost to the beginning of telephony. By connecting the transmitter and its battery to the primary and the line and receiver to the secondary of the coil great changes in the strength of the variable current on the line are produced, enabling better reception at the distant station. For long lines amplifiers are used. Modern amplifiers consist of vacuum tubes and auxiliary apparatus enabling the voice and signaling currents to be transmitted over long distances.

*Automatic Telephone Exchanges* had been

in service in isolated installations of moderate size for some years, but in the interval since 1920 their development and increased use has been remarkable. The earlier installations by independent companies were of the so-called step-by-step system and this system is still in use. For very large telephone districts the panel type became the standard of the Bell System. This type in turn has been superseded for many new installations by the crossbar system.

The *crossbar system* accomplishes required connections with a much simpler mechanism. All motion is avoided and a direct method of switching is employed. The only movement required is that of a mechanical link to close the required set of contacts.

An outstanding feature of any of the systems is a device on the subscriber's instrument for transmitting a series of a definite number of successive impulses of current corresponding to the number of the party called. A line finder, at the central station called, is a selector whose function is to find a terminal of a particular line on which a call originates out of a group with which it is associated, and to connect a "sender" to that line. A comparatively large number of subscribers' lines may be served by a comparatively small number of line finders. The line finder finds the calling line and connects the selector and sender thereto. The sender switch receives the electrical impulses from a subscriber's dial on a decimal basis, stores them, and translates them to a nondecimal basis corresponding to the particular group of lines and trunks involved in the path of the call. The sender replaces the intelligence of the operator. The district selectors controlled by the sender, have the duty of selecting a particular group of trunks and one trunk of that group. They have the same function as the switchboard plug and cord, which in a manual station can be plugged by the operator into any one of a number of jacks which are the terminals of trunks or lines. There are "district selectors", "incoming selectors", and "final selectors" in the circuit, in the order named, from the calling line to the called line. The district selector selects a trunk to the proper exchange, either the home or a distant exchange. The incoming selector selects a trunk to the final selectors of the same exchange. The final selector selects the terminals of the line of the called party.

*Transoceanic Telephony.* Telephone conversations across the Atlantic Ocean inaugu-

rated a regular commercial service in 1927. At first it was only possible to communicate between New York and London but since that time the service has been extended to all England and the United States as well as to other continents and to ships at sea. At the end of 1949, it was possible to reach 96% of the world's telephones from the U.S.

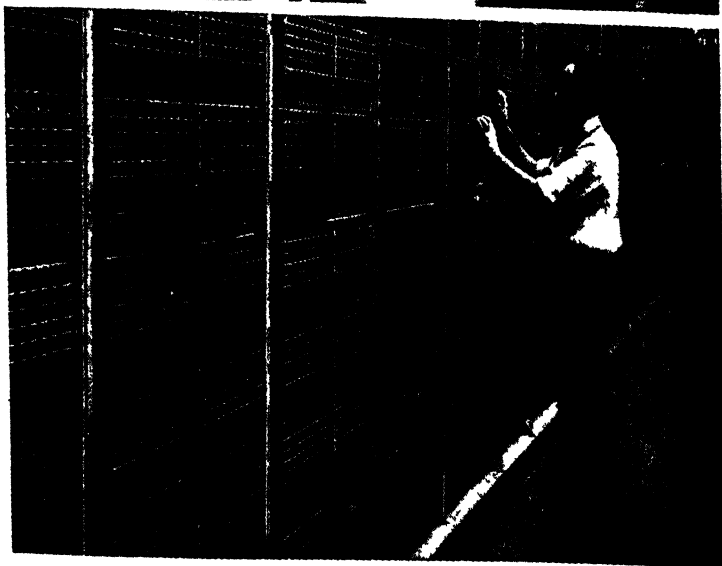
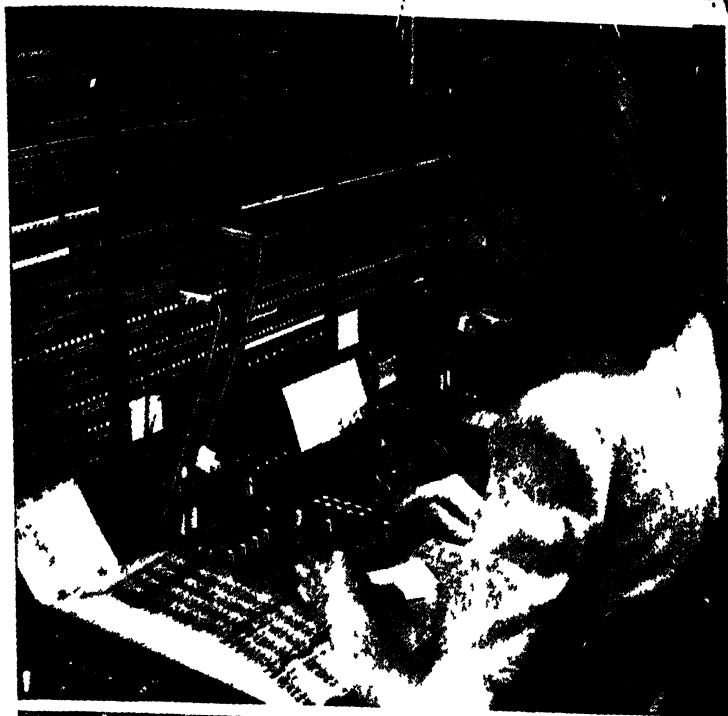
*Carrier-current Telephony.* This name was given to the method of sending telephone messages by means of frequencies above the voice range, extending from about 4000 to several million cycles a second. By this means it is possible with present methods to send as many as 600 telephone messages simultaneously over a single conducting medium. Carrier-current telephony techniques are also being used to send telephone messages over power distribution lines without interfering with the usual service of the lines.

*Amplifiers.* With the increasing distance covered and increasing complexity of systems it becomes necessary to amplify the messages at intervals of five to two hundred miles, depending upon the type of line structure and communication system. For this purpose, the electron tube has been most satisfactory.

*Coaxial Cable.* A further advance in obtaining a number of circuits from cable conductors by carrier means is the development of the coaxial cable. The cable is merely a pair of conductors, one a small tube, the other a wire held at the center of the tube, by which a large number of messages can be transmitted simultaneously. An experimental installation of this cable was begun in 1936. Today two of these coaxial units provide as many as 600 two-way telephone message circuits.

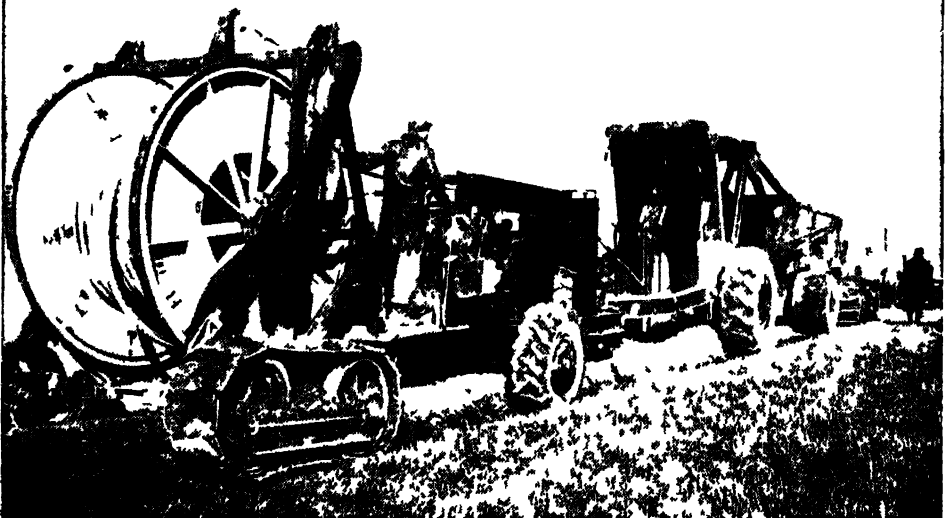
*Telephone and Broadcasting.* Long distance telephone lines have made possible the simultaneous transmission of radio programs from widely scattered broadcasting stations. To provide a wire system that could transmit the wide range of frequencies inherent in music, cable systems have been equipped with special loading coils about every half mile. The system of special telephone circuits set aside for broadcasting purposes comprises a total of about 155,000 miles of wire lines. Of these, about 115,000 miles are in regular full-time use for chain broadcasting while the rest are held in reserve for frequent use in special broadcasts and for assuring continuity of service. Thus it is possible for multiple stations to be grouped for the





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*Top* Long distance operator completing a call by manipulating keys at a switchboard.  
*Bottom* Rows of crossbar dial switches in a long distance telephone center.



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*Top, left Fanned out section of an eight tube coaxial telephone cable Top, right Telephone  
lineman at work atop a telephone pole Bottom Laying and winding cables*

broadcasting of special events of national interest, as, for instance, when more than 400 stations are enabled to broadcast Presidential addresses from Washington.

**TELEPHUS**, in Greek legend, a king of Teuthrania, in southern Mysia, the son of Auge, daughter of King Aleus of Tegea, and the hero Hercules. At the birth of Telephus, Auge's father enclosed mother and child in a chest and cast them into the sea. The chest floated across the Aegean Sea to the mouth of the Caicus R. in Mysia, where they were saved by King Teuthias, who married Auge and brought up Telephus. Telephus later succeeded to the throne. According to another version of the legend, the infant was taken from its mother and abandoned on a mountain, and Auge was cast into the sea, reached Mysia, and was adopted by Teuthias. Telephus was suckled by a doe, and upon reaching manhood went to Mysia to aid the king against his enemies; for his services he was given as his bride the adopted daughter of Teuthias, Auge, whom he recognized as his mother only just before the wedding was to take place. When the Greeks were on their way to Troy, they landed by mistake in Teuthrania and Telephus was wounded by the hero Achilles. Informed by an oracle that only the man who had wounded him could cure him, Telephus went to the Greek camp at Aulis and was healed by the rust from Achilles' spear. He then guided the Greeks to Troy, but refused to take part in the war.

**TELESCOPE**, essentially a lens or mirror to form an image of a distant object, together with a microscope to enable the observer to examine this image in detail, or a photographic camera or some form of spectroscopic apparatus.

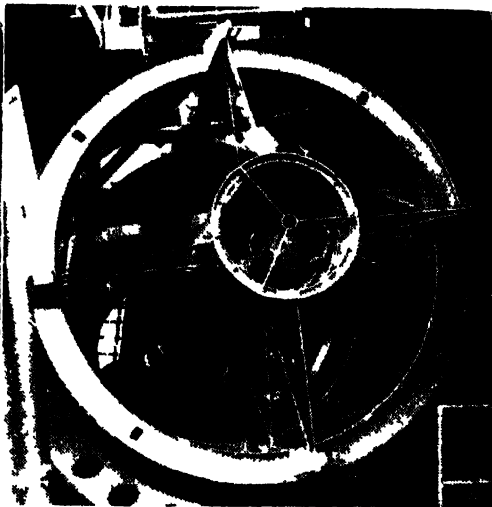
The invention of the telescope was doubtless accomplished in Holland, but there is some confusion and controversy to be encountered in attempting to determine the original inventor. It seems certain that the instrument was known more or less about Europe, but the honor of its invention is usually given to Galileo, who was the first to describe it and exhibit it in a complete form (May, 1609). To Kepler we owe the discovery of the principle of the astronomical telescope with two convex lenses. This idea was actually employed in a telescope constructed by Father Scheiner (*Rosa Urvina*, 1630). The difficulties due to spherical aberration were early experienced by opticians and astronomers, and in an attempt to

obviate them astronomical telescopes were constructed of considerable focal length and power.

The invention of the achromatic object glass by Dollond in 1757-58 and the improvement of optical flint glass, which commenced in 1754, soon made possible the construction of improved telescopes; but these were all of modest dimensions, and until well into the nineteenth century few if any object glasses were constructed greater than 12 inches in diameter. The discovery of methods of making large disks of flint glass was made by Guinand, a Swiss mechanic, who then became associated with Fraunhofer, and telescopes as large as 10 inches aperture were readily made. His successors made instruments with object glasses 15 inches across.

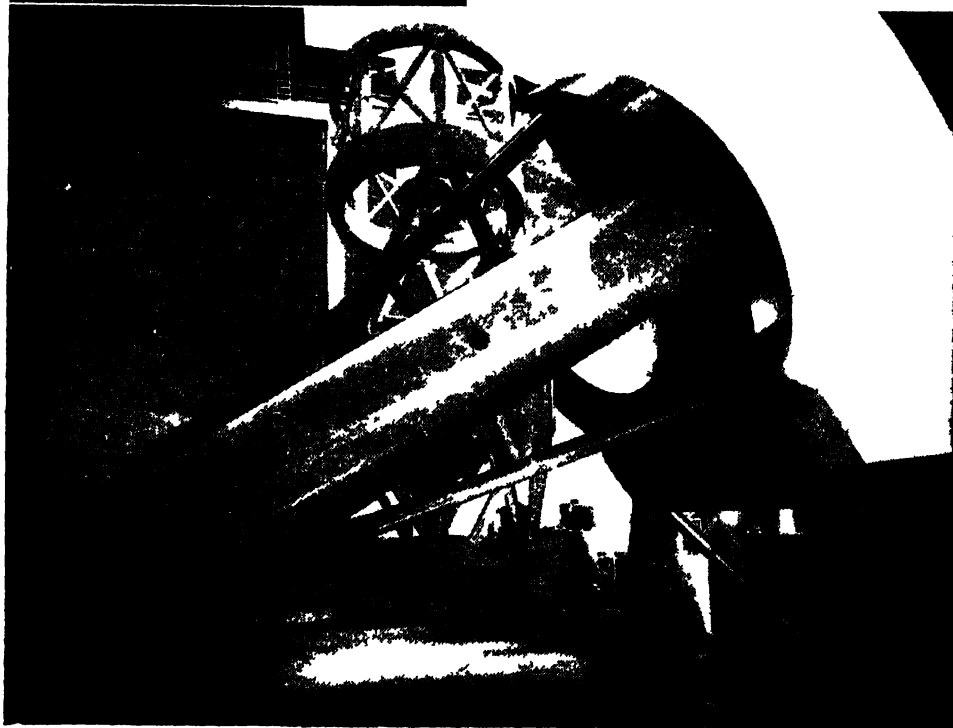
The next successful manufacturer of telescope lenses was Alvan Clark of Cambridgeport, Mass., who, from the time when an object glass manufactured in his shop was purchased by the Rev. W. R. Dawes of England, gradually achieved the highest rank as a maker of telescope lenses. With him was associated his son Alvan G. Clark. At the Cambridgeport works were constructed the lenses not only for the leading American observatories, but also for the Imperial Russian Observatory in Pulkova and other European institutions. Other makers of reflecting telescopes in the United States have been Brashear in Pittsburgh, Pa., who was succeeded by J. W. Fecker, Warner, and Swazey, while in Europe, Grubb of Dublin, Henry Brothers of Paris, and Steinheil in Germany were notable for their work.

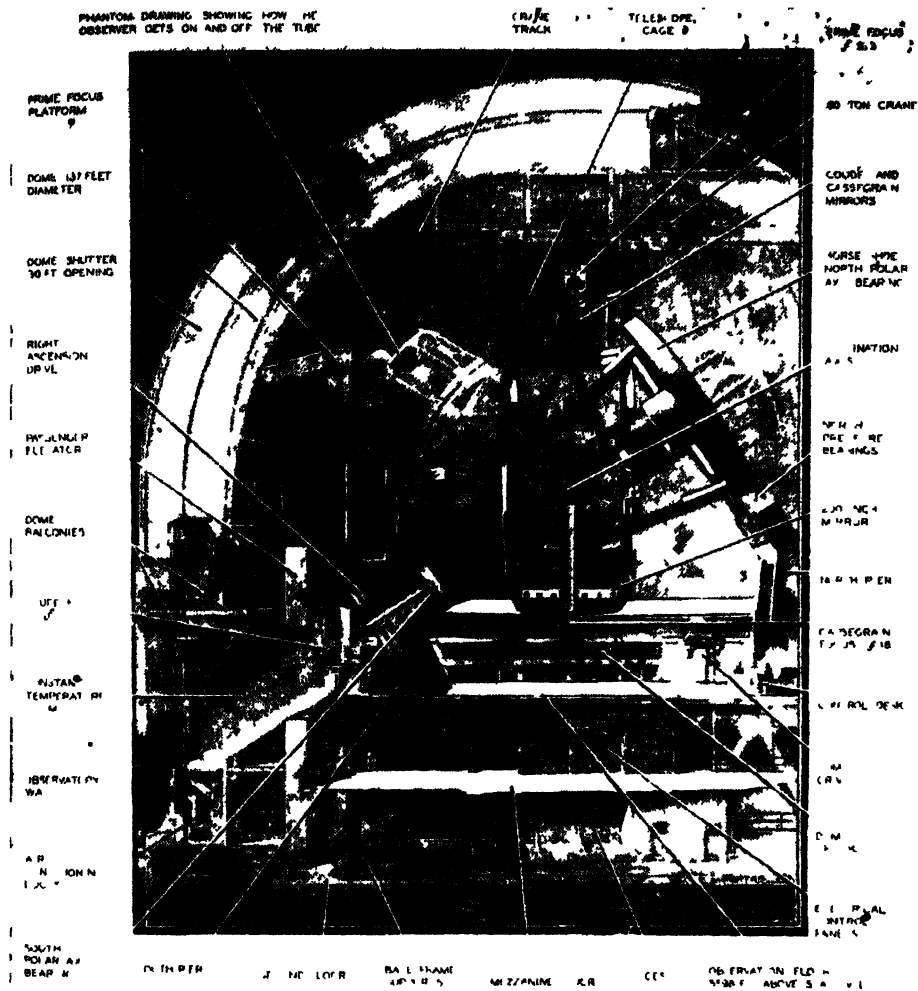
The formation of an image by a concave mirror has been employed in the reflecting telescope, of which numerous varieties have been devised and with which many of the most important astronomical discoveries have been made. Father Zucchi, an Italian Jesuit, was the first to use an eye lens to view the image produced by a concave mirror (1616-52), but to Gregory is due the first description of a telescope with a reflecting mirror, and the instrument has since been known by his name. An actual working instrument based on this principle was devised and constructed by Isaac Newton. In these telescopes the great difficulty was viewing the image, as the eyepiece and the head of the observer would cut off a large portion of the incident rays. In the Gregorian telescope this was obviated by the interposition of a second concave mirror, which reflected the rays to the eyepiece. Draper used a total reflection



Yerkes Obs Mt Wils n Pal mar Obs

OBSERVATORY TELESCOPES Left 40 inch re-  
fracting telescope at Yerkes Observatory, Wis-  
consin Above Observer seated in prime focu-  
s of 200 inch reflecting telescope at Mt Palomar  
California Below Side view of the 200 inch  
telescope at Mt Palomar





Mt Wilson Palomar Observatories

*Drawing showing parts and operation of 200 inch telescope at Mt Palomar, California*

prism instead of the plane mirror with considerable success, being one of the few astronomers in the United States to construct a reflecting mirror

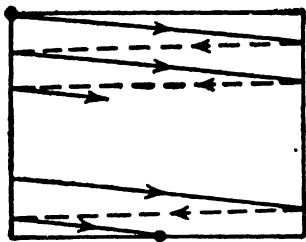
Cassegrain employed a convex mirror instead of a concave one. Herschel obtained satisfactory results by tilting his mirror and placing the eyepiece below the axis of the instrument, so that it was not in the way of the incident rays. Herschel's mirrors were as large as 4 feet in diameter, with a tube 40 feet in length. The mirrors for reflecting telescopes were usually made of speculum metal, which is composed of a mixture of copper and tin, until Liebig discovered the

method of depositing a film of silver on a glass surface. The use of silvered glass for mirrors was suggested by Steinheil, and later by Foucault, and finally met with general adoption as it not only facilitates the construction of the mirror, but makes possible its resilvering at any time without the destruction of its configuration. Silvering the mirror has been superseded by coating the mirror with aluminum, which lasts much longer.

The first equatorial mounting is ascribed to Lassel. In England telescopes were mounted by having the polar axis supported at each end, but the German system, where



individual tone elements of the facsimile and the television image appear on the receiving surface one after another in temporal succession. In facsimile these elements are printed or photographed and accumulate to form a whole image as the area is traced out; in television they accumulate to form an image because the character of the chemical coating on the television screen retains each element for a short time, and because of the



From *Basic Television—Principles & Servicing*,  
by Bernard Grob, McGraw Hill

Fig. 1

phenomenon of persistence of vision (q.v.) in the viewer.

**Scanning** Breaking up an image into a sequence of individual elements which can later be reassembled into the proper positions to recreate the picture is accomplished by a technique known as scanning. The eye of the scanner sweeps over the entire picture in much the same way as the eye of a reader sweeps over a page of print, word by word and line by line. Facsimile scanning is usually done by a moving photoelectric cell (q.v.) which passes over an illuminated picture. The variations of intensity of each particular portion of the picture as registered by the electric eye are transmitted ultimately to a beam of light which travels over a photosensitive film, the position of the light being exactly synchronized with the position of the receiving eye with respect to the picture area. Thus, when the entire area of the original picture has been traversed, the picture has been *scanned*, and the signal generated in the course of the process may be used to create a duplicate at the site of the receiving apparatus.

Various means of scanning mechanically and electrically have been devised, some of which are described below under *History*. Almost all modern television systems, however, rely upon the motion of a beam of electrons which sweeps across the screens of camera tubes or receiving tubes by electrical means. The advantage of scanning with an

electron beam is that the beam can be moved with great speed and can scan an entire picture in a small fraction of a second.

Fig. 1 shows in simplified form the path followed by an electron beam in scanning the entire area of a picture or image. The solid lines represent the path of the beam over the image surface and the dotted lines the flyback or retrace periods. During these periods, which are necessary to bring the beam back to the starting point of the next line or the next entire scanning operation, the beam is arranged to be ineffective for scanning. The illustration shows a simple scanning pattern composed of comparatively few lines and a simple repetition of the scanning pattern. In actual television scanning a large number of lines are used and the pattern is scanned in two interlaced parts.

A complete individual scanning pattern such as that shown produces a single static picture similar to a single frame of motion picture film. As the pattern is repeated a number of times per second, changes in a moving image are recorded and these changes blend into continuous motion for the observer just as do the changes recorded in successive frames of motion picture film.

The greater the number of lines scanned from top to bottom of an image and the greater the number of elements recorded on each line as it is scanned from left to right, the greater is the "definition" of the image reproduced. Definition is the capacity of the image to show fine details or small objects, and in general is equivalent to the clarity of the picture. In television the frequency of repetition of the pattern, the number of scanning lines used, and the number of elements reproduced in the scanned lines must be standardized for any given system in order that the television transmitter and receiver can operate in synchronism. As a practical matter these so-called television standards are set up for all transmitters and all receivers used in the entire country. In the United States broadcasters and receiver manufacturers have agreed on a standard of 525 horizontal lines per frame and a frequency of 30 frames per second. Similarly the number of "picture elements" in each line has been limited for technical reasons to 426 elements per line. The result is an image that consists of 223,650 individual elements for the entire frame; these elements are repeated 30 times per second to give a total of 6,709,500 transmitted in each second.

Clearer television pictures can be obtained and have been obtained experimentally by increasing the number of lines and elements. The system used at present is the best that is technically obtainable for present transmission frequencies. For purposes of comparison, the best theoretical definition obtainable with a television image on the present standards is equivalent to that found in a half-tone engraving 3 in. by 5 in. using a screen of the type used in illustrating this encyclopedia. Compared to the definition of standard 35 mm. motion picture film of the type shown in theaters, the television image contains less than  $\frac{1}{3}$  as many elements and thus is far less detailed.

**The Television Signal.** The television signal is a complex electric wave of voltage or current variation which is composed of the following parts: a series of fluctuations which correspond to the fluctuations in light intensity of the picture elements being scanned, a series of synchronizing pulses which lock the receiver to the same scanning rate as the transmitter, an additional series of "blanking pulses", and a frequency-modulated signal carrying the sound which accompanies the image. The first three of these elements make up the "video signal" and are discussed below. The sound signal is of the type discussed in the article **FREQUENCY MODULATION**.

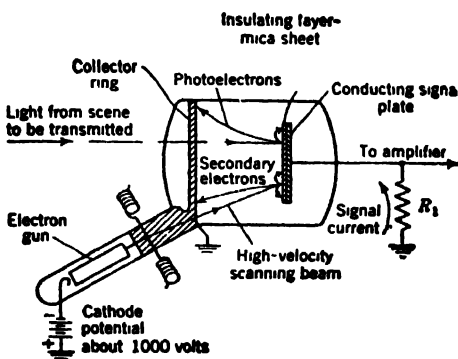
Fluctuations of current or voltage corresponding to the variations in light intensity are often termed the camera signal. The frequency of this signal is about 4 million cycles per second, varying for each individual picture element. The method of producing the camera signal is dealt with in the section **Television Cameras** below and its reproduction at the receiver in the section on **Kinescopes**.

Synchronizing pulses are short bursts of electrical energy generated by appropriate oscillators (see **ELECTRONICS**) at the transmitting station. These pulses control the rate of horizontal and vertical scanning of both camera and receiver. The horizontal synchronizing pulses occur at intervals of  $\frac{1}{15,750}$  of a second and last for approximately  $\frac{1}{200,000}$  of a second. The vertical synchronizing pulses recur at intervals of  $\frac{1}{60}$  of a second and last approximately  $\frac{1}{5000}$  of a second.

Blanking pulses make the electron beam

inoperative in the camera and the receiver during the time which it takes the electron beam to "fly back" from the end of one horizontal line to the beginning of the next and from the bottom of the vertical pattern to the top. The timing and structure of these pulses is highly complex.

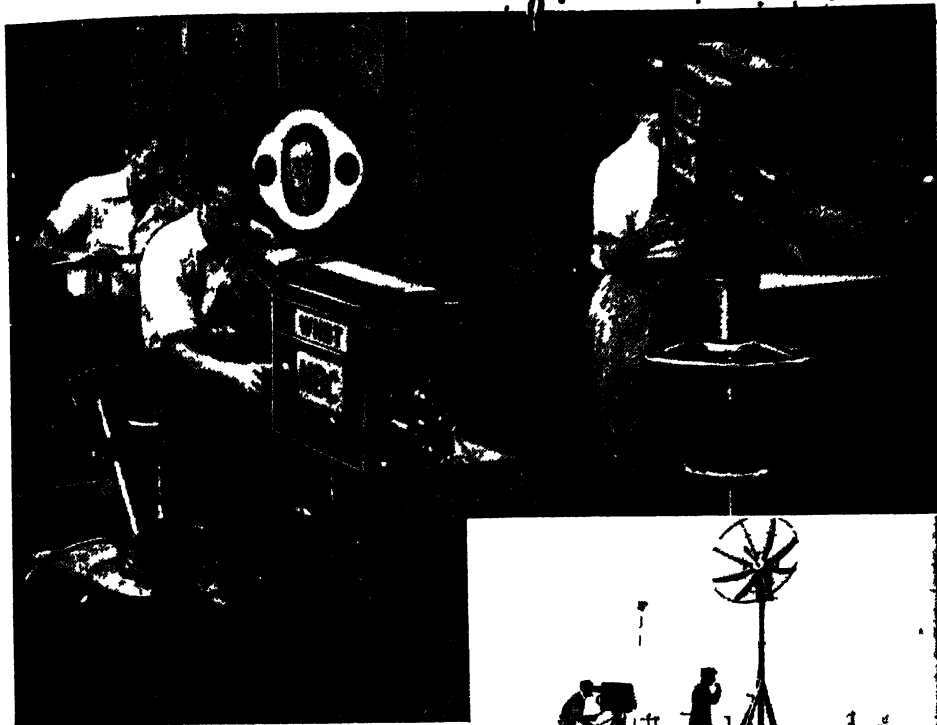
**Television Cameras.** The television camera resembles ordinary cameras in being equipped with a lens or lenses and a means of focusing the image formed by the lens on a sensitive surface. The sensitive surfaces used are electronic tubes called camera tubes which have the ability to transform variations in light intensity into variations in electrical charge or current. The original type of camera tube was the *iconoscope*, but this has been supplanted to some extent by newer types, especially the *image orthicon*.



From *Basic Television—Principles & Servicing*  
by Bernard Grob, McGraw Hill  
Fig. 2

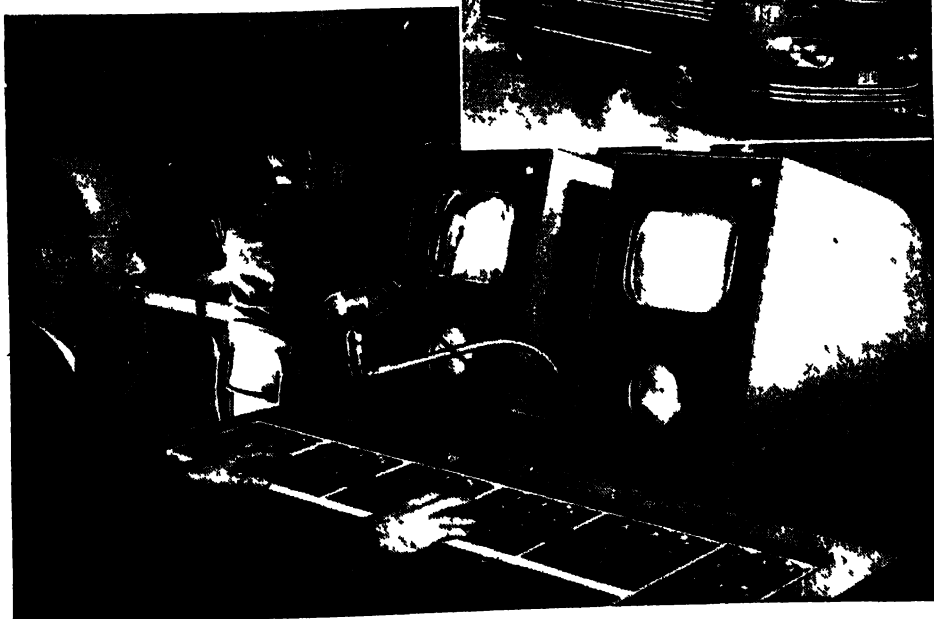
The operation of the iconoscope can be understood by referring to Fig. 2. Light from the camera lens enters the tube from the left and, falls in focus upon the signal plate. The front of this plate, which is made of an extremely thin sheet of mica, is covered with a very fine mosaic pattern made up of globules of silver coated with cesium or some other light-sensitive material. Each individual globule is separated from the others by a small space and is therefore insulated electrically from them. The back of the signal plate is coated with graphite, which conducts electricity. In the neck of the iconoscope is an electron gun, a source of an electron beam which is directed toward the mosaic. When light strikes one of the silver-cesium globules, this globule emits a number of electrons proportional to the intensity of the light because of its photosensitive properties. As a result the globule be-

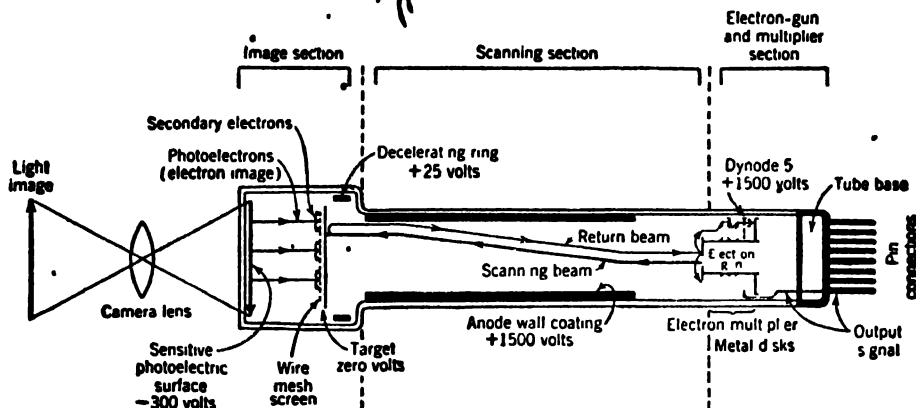




NBC Photos, Allen B. DuMont Laboratories

*Above Television cameras on an indoor set  
Right Mobile-television unit for televising  
spot news events and features Below En-  
gineer at control panel during broadcast*





From *Basic Television—Principles and Servicing*, by R. L. Colwell, McGraw-Hill  
Fig. 3

comes positively charged. The total effect of the lens image on the mosaic plate is to create a pattern of individual positive charges which correspond in position and intensity to the light image thrown on the plate by the lens. By electrostatic induction this pattern of charges causes a similar pattern of negative charges to appear on the back of the plate.

The beam of electrons from the gun traces a scanning pattern across the front of the mosaic under the influence of electrical impulses supplied by the synchronizing generators to two pairs of magnet coils at the neck of the iconoscope. One pair of these coils deflects the beam horizontally, and the other, placed at right angles to the first, deflects the beam vertically. As the electron beam strikes each positively charged globule of the mosaic it releases the charge of the globule (by supplying the missing electrons which were driven off by the influence of light) and at the same time varies the induced charge on the back of the signal plate. The result is a constantly varying charge on the signal plate. This fluctuation is the camera signal and its intensity varies in exact proportion to the light image on the mosaic as the electron beam scans the mosaic. (This description of the operation of the iconoscope has been somewhat simplified by omitting a description of the emission of secondary electrons from the mosaic under the influence of the scanning beam. These electrons are "collected" by a metal coating at the front of the tube, called the collecting ring, which is connected to ground and which completes the signal circuit.)

As a camera tube the iconoscope has several disadvantages. One of the most impor-

tant is that it requires extremely strong illumination of the subject to produce a usable signal. When television cameras are used in the studio under controlled light conditions this disadvantage is not serious, but the iconoscope is unsuitable for use in the televising of news events under adverse light conditions. A number of other camera tubes have been invented to overcome this difficulty. The most successful of these is the image orthicon. The sensitivity of this tube is such that it will produce a camera signal under any lighting conditions which are suitable for viewing with the naked eye. In demonstrations the image orthicon has produced adequate television images of scenes lit only by candles. An added advantage of the image orthicon is that it uses a comparatively small screen and can thus be incorporated into a camera of small size.

The image orthicon tube is shown in Fig. 3. It has a flat glass window at one end which serves as its screen. The inner side of the plate is coated with a continuous layer of silver cesium to form a sensitive photoelectric surface. Spaced close behind this layer and parallel to it is a target made of glass having low electrical sensitivity. In front of the target is a screen of wire mesh having as many as 1000 openings per square inch. Back of the target a concentric metallic ring coated on the inside of the tube forms a decelerating element, and behind this ring is a concentric cylindrical coating within the neck of the tube which serves as a positive plate or anode. At the end of the tube is an electron gun to provide a beam of electrons and a structure called an electron multiplier.

When light strikes the sensitive coating of

the tube, electrons are emitted. These electrons move in the direction of the target, which is kept at a positive potential with respect to the sensitive surface. Before reaching the target the electrons pass through the openings, which comprise about 60 percent of the total surface of the wire mesh. The electrons travel in straight lines from photo-electric surface to target and are prevented from scattering by the action of a magnetic field imposed by a magnet (not shown in the figure) which surrounds the image section of the tube.

The electrons which strike the target cause the emission of "secondary" electrons in the proportion of several electrons to each individual electron which reaches the target from the photo surface. This secondary emission builds up a pattern of positive charges on the target plate corresponding to the light image on the photo surface. Light areas are more positive and dark areas less positive in this charge image. The secondary electrons from the front of the target are picked up by the image screen.

The electrical properties of the glass used for the target screen are such that its resistance to flow of an electrical charge or current is much greater along the surface of the screen than through the screen. As a result, the various positive charges on the outer side of the target do not equalize themselves over the surface but pass through to the inner side of the target, reproducing the charge pattern on the inner as well as the outer side of the target.

The scanning mechanism of the tube consists of the electron gun and the cylindrical anode in the neck of the tube, which act together as a source of an electron beam, and a set of deflecting coils (not shown) mounted outside the neck of the tube like the deflecting coils of the iconoscope. The scanning beam is slowed, just before it strikes the target, by the action of the positively charged decelerating ring and reaches the target without sufficient energy to knock out secondary electrons. As the beam strikes each portion of the positive electrical charge pattern on the target, it gives up enough electrons to neutralize the positive charge at that point on the target. The remaining electrons are reflected back toward the electron gun and its associated electron multiplier. In areas with a strong positive charge, corresponding to light areas of the image, more electrons are needed to neutralize the charge and, as a result, fewer electrons are reflected.

The electron multiplier, which consists of a disk surrounding the aperture through which the electron gun "fires" followed by a succession of symmetrical elements behind this disk, acts as an amplifying device by secondary electron emission. The first disk in a typical image orthicon is held at a positive potential of about 200 volts, and the succeeding elements or dynodes are held at higher positive potentials. Electrons striking the disk knock off a greater number of secondary electrons, which, in turn, knock off still more electrons as they pass from dynode to dynode. As a result the camera signal is "multiplied" as it passes from element to element.

Several other types of camera tubes are sometimes used in modern television transmission, among them is the *image dissector* in which the entire electrical image is moved past an aperture to accomplish the scanning action.

*Television Transmitters.* Except for the special circuits required to produce the synchronizing and blanking pulses required for scanning, and the various types of special equipment used to examine or monitor the signals from the television camera, the remainder of a television transmitting system resembles that of an ordinary amplitude-modulated broadcasting station. The sound equipment is in no way different from that used in ordinary FM broadcasting and the sound signal is sometimes broadcast from its own separate antenna, forming in effect a completely separate broadcasting unit.

Television broadcasting, however, has a number of special problems which are not encountered in ordinary sound broadcasting. The chief of these is that of "band width". The process of modulating an electromagnetic wave (see MODULATION) involves the generation of a series of frequencies called sidebands which correspond to the difference in frequencies between the radio of "carrier" frequency and the modulating frequencies. In ordinary broadcasting in which the signal employs only frequencies up to 10,000 cycles (10 kilocycles) per second, the sidebands occupy little space in the spectrum of frequencies and different stations can be assigned carrier frequencies as little as 5 kilocycles apart without interference. The frequency range of a single television signal, however, is about 4,000,000 cycles or 4000 kilocycles and such signals therefore occupy about 40 times as much space as the entire frequency band used for standard broad-

casting. In order to provide sufficient channels to accommodate a number of television stations serving the same area, it is necessary to utilize comparatively high transmission frequencies for the television carriers. The channels at present assigned to television broadcasting in the U.S. are twelve in number as follows: Channel 2, 54-60 megacycles (megacycles are millions of cycles and are abbreviated mc); Channel 3, 60-66 mc; Channel 4, 66-72 mc; Channel 5, 76-82 mc; Channel 6, 82-88 mc; Channel 7, 174-180 mc; Channel 8, 180-186 mc; Channel 9, 186-192 mc; Channel 10, 192-198 mc; Channel 11, 198-204 mc; Channel 12, 204-210 mc; and Channel 13, 210-216 mc. In the early days of television broadcasting in this country, beginning about 1940, an additional channel, Channel 1, 44-50 mc, was assigned to television but was later reassigned to other radio services. Besides these channels a number of extremely high frequency channels in the range of 480-920 mc are available for assignment but at present are employed only for experimental purposes.

The use of high frequencies for television broadcasting has introduced a number of problems which are quite different from those of conventional sound broadcasting. The range of low-frequency radio signals is quite extensive, reaching to hundreds and even thousands of miles. High-frequency signals, on the other hand, are comparatively limited in range and often do not extend beyond the actual line of sight from place to place as determined by the curvature of the earth. Thus, while the service area of a standard broadcasting station may have a radius of well over 100 miles, that of a television station is usually limited to about 35 miles or even less, depending upon the height of the transmitting and receiving antennas. Provision of complete television coverage for a country as large as the U.S. therefore requires a much greater number of television stations than are employed for standard broadcasting. The only reason that it is possible to provide a large number of stations with the limited number of twelve channels is that the ranges of the stations are short and the same channels can be assigned to two or more stations in different localities without interference.

Another problem encountered in the use of high frequencies for television broadcasting is that radio waves of such frequencies behave very much like light waves and are reflected from solid objects such as hills

or buildings. Often several such reflections from a single station will be received simultaneously at a given receiver location, giving rise to multiple or "ghost" images on the receiver screen because the reflected signals have traveled different distances and therefore arrive at the receiver at slightly different times. The problem of reflected signals as well as the problem of receiving television signals at distances beyond the normal service range have been solved to a great extent by the use of special types of receiving antennas. These antennas are designed to have a very high efficiency or "gain" so that, in effect, they amplify weak signals. Most of them are also directional in character, having a high efficiency for signals received from one direction and comparatively low efficiency for signals arriving from other directions. By orienting a directional antenna correctly, it is possible to select one of several reflected signals and eliminate the others, thus doing away with ghost images at a particular location. For discussion of the factors affecting antenna design see the article ANTENNA.

The frequency width of the television signal itself has given rise to still another practical problem in connection with commercial television broadcasting—the problem of relaying television programs from one station to another for network broadcasting. In ordinary sound broadcasting practice, programs are relayed over ordinary telephone lines from city to city. Many of these lines are available and make it easy to distribute a single program to stations in every part of the country. Ordinary wire lines, however, will not carry the broad band of frequencies necessary for television. The only type of land line suitable for such transmission is the *coaxial cable*, a line consisting of a cylindrical outer conductor with a second conductor in the form of a wire running coaxially through it. Coaxial cables are expensive to construct and maintain and comparatively few of them have been built. A simpler answer to the question of relaying television programs has been found in the use of radio relay stations. These stations receive the television signal by radio, amplify it, and retransmit it automatically. By stringing a chain of such relay stations between two cities, a program originating in one city may be transmitted and rebroadcast to the other. One typical chain between New York and Boston employs seven such relay or repeater stations spaced about 30 miles apart.



CBS Photos

*Above: An orchestra performing at a television broadcast. Right: Technician giving cameraman signal on television set. Below: United Nations members as seen on television.*



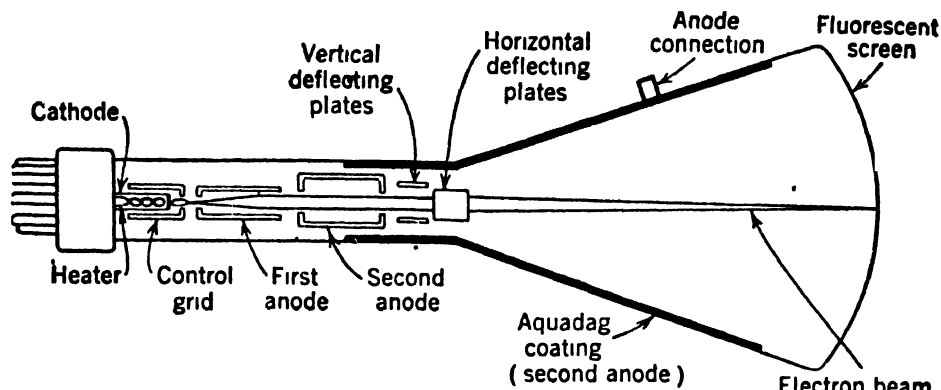


FIG. 4 — Principles & Structure by BENJAMIN L. MCGRAW HILL  
Fig. 4

A method proposed for increasing the range of individual television broadcasting stations is to place the transmitter and its antenna in an airplane flying several miles above the earth. This system called *stratavision*, has been used experimentally and has provided good reception over a radius of 200 miles. It is especially well suited to television broadcasting in thinly populated areas such as those of the western U. S.

**Kinescopes** The heart of the television receiver is the picture tube or kinescope which translates the electrical impulses of the television signal into visible light. The kinescope stands in the same relation to the receiver as the camera tube does to the television transmitter. In its actual structure the kinescope is a cathode ray tube, so called because it generates a beam of electrons originating at the cathode or negative electrode.

Fig. 4 shows diagrammatically the action of a typical kinescope. Housed in the narrow neck of a funnel shaped tube is the electron gun consisting of a heated cathode filament, a control grid and two anodes. Electrons emitted from the cathode are focused into a narrow beam by passing through a narrow opening in the control grid which is held at a negative electrical potential with respect to the cathode. This slight negative "bias" on the grid has the effect of driving some of the electrons back to the cathode and allowing only those electrons to pass which travel in a beam toward the opening. The two anodes are both at positive potentials with respect to the cathode and thus attract electrons. The combined effect of the positive fields of the two anodes is to focus the electrons flowing through the tube so that they all strike a single point on the

screen at the large end of the tube and provision is usually made to vary the relative strength of the fields to focus this spot exactly on the screen. Occasionally a magnetic focusing coil is substituted for the two focusing anodes.

The screen is formed by coating the inner end of the tube with any one of several types of chemicals known as phosphors which have the property of glowing when subjected to an electric charge such as a beam of electrons. When the tube is operative the electron beam is visible on the face of the tube as a small luminous spot.

In the kinescope shown the electron beam is moved for scanning by means of two pairs of deflection plates. When a positive charge is placed on one of these pairs and a negative charge on the other, the beam is deflected away from the positively charged plate and toward the negatively charged one. The first of the pairs of plates in the tube diagrammed here deflect the beam up and down and the second pair deflect it from side to side. Oscillating scanning voltages are generated in the receiver and are exactly synchronized to those of the transmitter by means of the synchronization pulses from the transmitter. Thus when a station is tuned in on the receiver the scanning rate and sequence of the kinescope are automatically locked to those of the camera tube at the transmitter.

The camera signal from the transmitter is amplified by the television receiver and applied to the control grid of the kinescope. When this grid is driven negative by the signal, the grid repels electrons and, when the negative signal is strong enough, no electrons pass the grid and the screen is

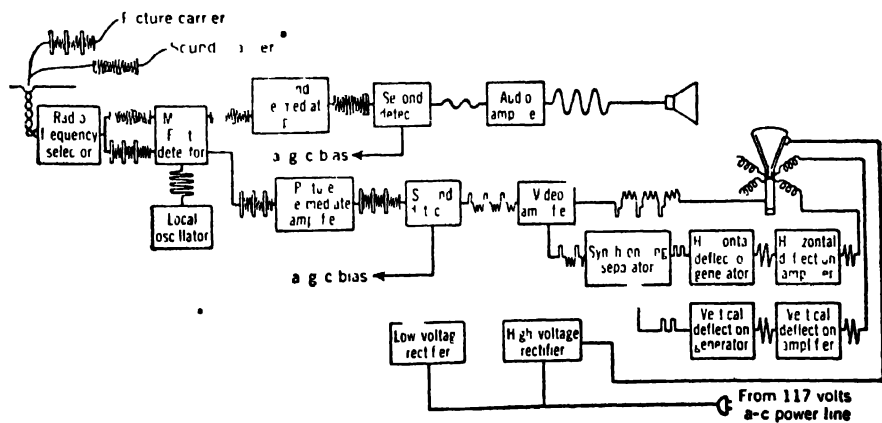
dark. In the event that the grid is driven moderately negative some electrons pass the grid and the screen shows a faintly luminous spot corresponding to gray in the original image. When the grid is not driven negative by the signal or is made more positive by it the screen shows a brilliant spot corresponding to white in the original image. By means of the combined action of the scanning voltage and the camera signal voltage the electron beam traces out a luminous pattern on the screen which is an exact reproduction of the original scene. The phosphors used on the screen continue to glow for a short time after they have been activated by the electron beam so that the individual spots blend into one another to form a continuous picture.

The size of the end of the ordinary kinescope tube determines the size of the picture on the screen. Kinescopes are manufactured with screens having diameters between 5 and 30 inches. Larger sizes are more desirable since they give bigger images which can be viewed simultaneously by more people. The construction of large diameter tubes, however, is expensive and difficult and the tubes themselves are more subject to breakage. In an effort to combine forming with using, kinescopes of impractical sizes are manufactured equipped with tube of comparatively small diameter and project the image from them on a much larger screen by means of a lens system. Projection kinescopes of this type permit much brighter and more brilliant images on the tube face and project the image on a large screen at a high voltage to produce the necessary intensity of

the electron beam. A typical projection tube may use a voltage of 25,000 volts or even higher as compared to 6000 to 12,000 volts for ordinary direct viewing kinescopes. The more powerful types of projection kinescopes are capable of projecting a television image large enough to fill the screen of a motion picture theater.

**Television Receivers** The circuits of modern television receivers are necessarily complex but the general scheme of their operation is easily understood by reference to Fig. 5. The signal received by the antenna is tuned and amplified in the radio frequency-selector stage. Passing on to the mixer stage the signal is combined with the output of a local oscillator in the receiver which generates a steady frequency. This combination or mixing produces beat frequencies corresponding to the picture signal and the sound signal. Separated by selective filter circuits which pass one band of frequencies and reject all others, the two signals are then separately amplified. The sound signal is amplified by an intermediate amplifier, demodulated and amplified again by an audio amplifier as in a conventional frequency modulation receiver of the type described under **FREQUENCY MODULATION**.

The picture or video signal is also amplified by a separate intermediate amplifier and then detected (see **DETECTION**). After further amplification by a video amplifier, the signal is divided by filter circuits into two separate components. The camera signal and blanking pulses pass directly to the grid of the kinescope to control the intensity of the electron beam. The two sets of syn-



From *Basic Television—Principles & Servicing* by Bernard Grob, McGraw-Hill

Fig. 5

chromizing pulses are separated by filtering into the vertical and horizontal components and are applied to oscillators which generate the voltages to be used for deflecting the electron beam. The outputs of the vertical end of the horizontal oscillator are amplified and led to the appropriate sets of deflecting magnets at the kinescope tube to provide the proper scanning pattern.

**Color Television.** A number of systems have been devised for the transmission and reproduction of television images in full color, but none are entirely successful from the practical point of view, and color television is not yet being broadcast commercially. One such system employs segmented disks bearing transparent optical filters of red, green, and blue glass. One of these disks is revolved by an electric motor in front of the lens of the camera tube and the other, also driven electrically and synchronized to the camera disk by a special signal, revolves in front of the screen of the kinescope. As the disks revolve, successive red, green, and blue images blend, as the result of persistence of vision, into a single image in natural color according to the principle of color addition (see COLOR). This system of mechanical color separation has several major defects. It produces "color flash", a persistence on the retina of the viewer of the last single color seen before the viewer looks away from the image. To reduce flickering, the images are "degraded", that is, the number of scanned lines in each picture is reduced to less than eighty percent of the number of such lines used in black-and-white television, to permit increase in number of pictures per second. Degradation permits reception of color-television broadcasts by ordinary black-and-white-television receivers without use of an adapter. Another major defect in the mechanical system is that the size of the picture is limited because the diameter of the picture tube must be less than the diameter of the disk.

Several types of non-mechanical additive color television systems have been the subject of experiment. In one such system three separate camera tubes of the image-orthicon type are used, each incorporating an optical color filter so that it records only one of the primary colors. The output of this system is, in effect, three separate television signals which are transmitted as one. The receiver also consists of three separate video systems which feed their outputs to three separate kinescopes. The phosphors used on these

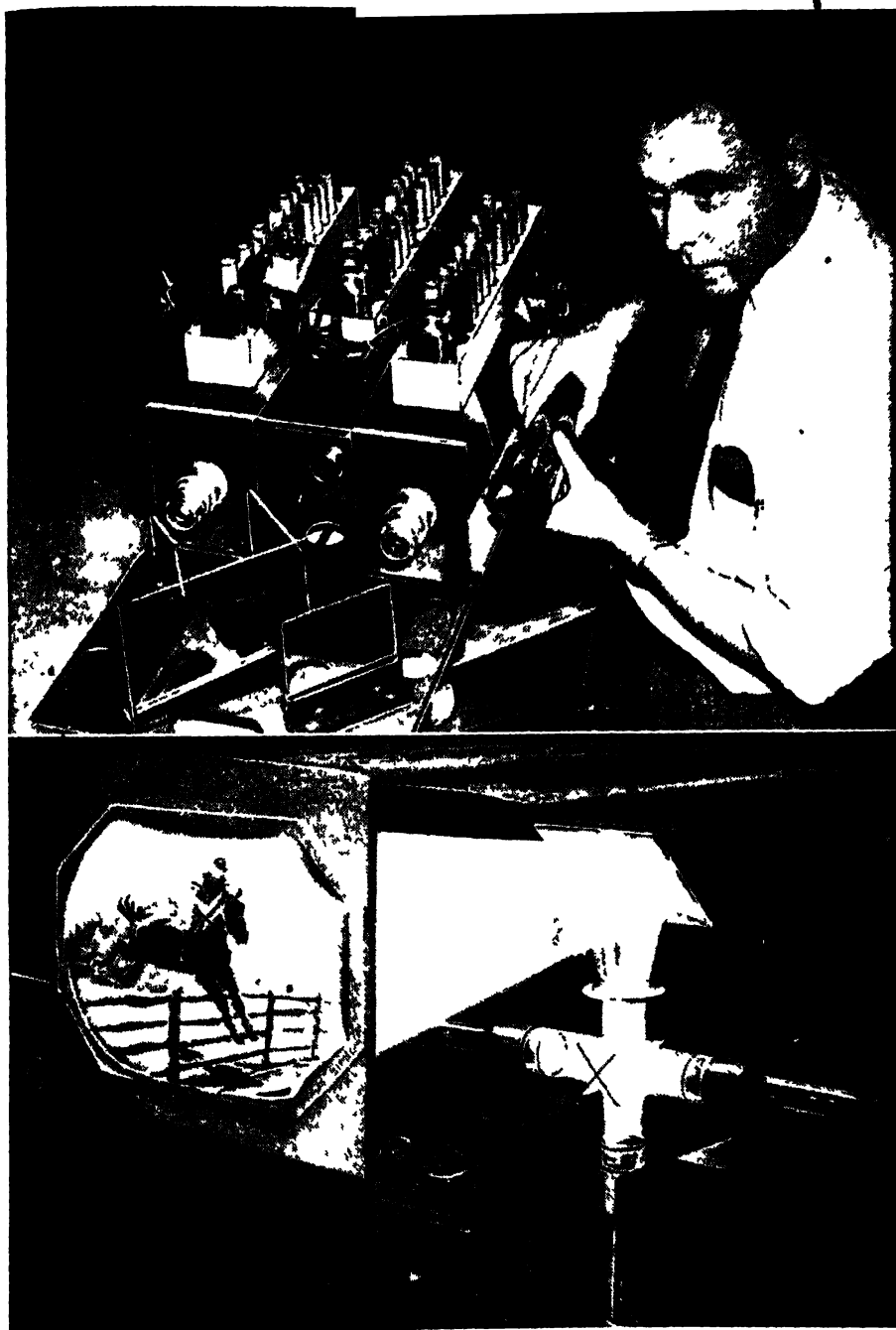
kinescopes are such that they produce images in the three primary colors and these images are projected by optical means so that they are superimposed upon a screen. Much attention has been paid to this so-called simultaneous color system because it is entirely electronic in operation and so its introduction on a commercial scale would not render the receivers used for black-and-white images entirely obsolete. Such receivers correspond to one channel of a simultaneous color receiver and could with minor adaptations be employed to receive black-and-white images from color transmissions. The simultaneous color system is in the experimental stage; early models are too expensive for ordinary commercial usage, the colors change erratically, and the images are subject to flickering effects and to the appearance of moving spots and extraneous images.

**History.** The history of the development of television has been basically the history of a search for an adequate device for scanning the image. The first such device was the so-called *Nipkow disk*, patented by the German inventor Paul Nipkow in 1884. This was a flat, circular disk which was perforated with a series of small holes arranged in a spiral radiating from the center to the rim. As the disk was revolved in front of the eye, the outermost hole scanned a strip across the top of the image, and the succeeding holes scanned strips lower down until the entire image had been scanned. With suitable lens systems, and by using photoelectric cells as transmission elements and electric lamps which could be varied in intensity as receiving elements, a number of wired and later wireless television systems were constructed. Because of its mechanical nature, however, the Nipkow disk failed to operate efficiently when made in large sizes and revolved at high speeds to obtain better definition.

The first truly successful television pickup devices were the iconoscope described above, which was invented by the American inventor Vladimir Zworykin in 1933 and the image dissector tube, invented by the American Philo Farnsworth at about the same time. With the availability of these tubes and the advances in radio transmission and electronic circuits which occurred in the years following World War I, practical television systems became a possibility.

The first public television broadcasts were made in England in 1927 and in the United States in 1930. In both instances mechanical





NBC Photos

*Top: Color-television camera with cover removed. Two dichroic mirrors allow green rays to pass to center lens while silvered mirrors reflect blue and red rays to lenses at left and right.*

*Bottom: Kinescopes and refractive optics are used to receive color.*

systems were used and the programs were not on a regularly scheduled basis. Television broadcasting on a regular service basis began in the U.S. on April 30, 1939 in connection with the opening of the New York World's Fair. Scheduled broadcasting was interrupted by World War II and not until after that war did a large number of broadcasting stations offer service.

**TELFORD, THOMAS** (1757-1834), Scottish civil engineer, born in Eskdale, Dumfriesshire. During his youth he was a stonemason and supervised the construction of numerous homes in London. He then turned to the designing and construction of canals, for which he is best known. Among the most famous of the canals which he designed are the Ellesmere Canal connecting the Severn, Dee, and Mersey rivers in England, begun in 1793 and finished in 1805; the famous system of artificial canals connecting a chain of natural Scottish lakes known as the Caledonian Canal (q.v.), begun in 1803 and completed in 1823; and the Gotha Canal connecting the Baltic and North seas, begun in 1808 and opened to seagoing traffic two years later. Among Telford's other construction projects are numerous roads and bridges in northern Scotland. In 1818 he was elected president of the newly founded Institution of Civil Engineers, serving in this position until his death; the Institution's Telford gold medal was so named in his honor. He was the author of *The Life of Thomas Telford, Civil Engineer, Written by Himself* (published posthumously in 1838).

**TELL, WILLIAM**, a legendary Swiss patriot of the 14th century. According to tradition, he was the leader of an uprising of the Swiss peasantry against their Austrian rulers, a revolt which purportedly resulted in the unification and independence of the Swiss nation. Tell is said to have won the freedom of the Swiss by successfully meeting the challenge of the Austrian bailiff Gessler, who offered to grant the demands of the populace if Tell, using a bow and arrow would shoot an apple from the head of his young son. The legend of William Tell first appeared in literary form in a ballad written probably in the 15th century; it later served as the basis for the famous drama *Wilhelm Tell* (1804) by the German playwright Johann von Schiller (q.v.), and for the opera *Guillaume Tell* (1829) by the Italian composer Gioacchino Rossini (q.v.).

**TELL CITY**, a city of Perry Co., Ind., situated on the Ohio R., about 47 miles E.

of Evansville. Transportation facilities include a railroad. The surrounding region contains deposits of clay and coal. The city is an industrial center, with factories producing marine equipment, radio tubes and cabinets, furniture, plumbing fixtures, flour, and tobacco products. Tell City was founded by Swiss immigrants in 1857. Pop. (1950) 5735.

**TELL-EL-AMARNA**, or TELL-EL-AMARINA. See ARCHAEOLOGY.

**TELLEZ, GABRIEL** (1571-1648), Spanish dramatist. He joined the Brothers of Charity in Toledo, and died prior of the monastery of Soria. His pieces are partly comedias, partly interludes, and *Autos Sacramentales*. Some of his comedies are still presented.

**TELL-HALAF**, site of the ancient city of Subareans, situated in Upper Mesopotamia, first excavated in 1911 and again in 1927-29, by Baron Max von Oppenheim. He discovered among many things colossal statues of Subarean gods. The Subarean culture and art goes back to 4500 B.C.

**TELLICHERRY**, seaport of Malabar District, Madras, Union of India, situated about 45 miles N.N.W. of Calicut. Coffee, cardamoms, and sandalwood are the chief exports. Pop. about 29,000.

**TELLIER, CHARLES** (1828-1913), French engineer, born in Paris. He early made a study of motors and compressed air. In 1868 he began experiments in refrigeration, which resulted ultimately in the refrigerating plant as used on ocean vessels. He wrote *Histoire d'une Invention Moderne, le Frigorifique* (1910).

**TELLURIUM** (from Lat. *tellus*, "the earth"), a brittle, silver-white, semimetallic element, of atomic number 52, atomic weight 127.6 and symbol *Te*, belonging to the sulfur-selenium family; see *SULFUR*. It was recognized as an element and given its name in 1792 by the German chemist Martin Klaproth. Tellurium occurs in the pure state, or is found in combination with gold, silver, copper, lead, and nickel in such minerals as sylvanite, petzite, and tetradyte. Occasionally it is found in rocks as tellurite, or tellurium dioxide,  $TeO_2$ . The slimes from lead and copper refineries and the flue dusts from telluride-gold deposits are the principal commercial sources. Deposits occur in Mexico, Germany, South America, western Australia, and Ontario, Canada. In the United States, small amounts of the element are obtained from rocks in Colorado and California.

Tellurium is a comparatively stable element, insoluble in water and hydrochloric acid but soluble in nitric acid and aqua regia. It has a melting point of  $452^{\circ}\text{C}$ . ( $845.6^{\circ}\text{F}$ .), a boiling point of  $1390^{\circ}\text{C}$ . ( $2534^{\circ}\text{F}$ .), and a specific gravity of 6.24. Three isotopes are known, each having valences of two, four, or six. Commercially, tellurium is often obtained as a sludge formed during the electrolysis of copper and lead. It is also prepared by the reduction of telluric oxide, forming a grayish-white, metal-like powder.

Tellurium reacts with an excess of chlorine to form tellurium dichloride,  $\text{TeCl}_2$ , and tellurium tetrachloride,  $\text{TeCl}_4$ . It is oxidized by nitric acid to produce tellurium dioxide,  $\text{TeO}_2$ , and by chromic acid to produce telluric acid,  $\text{H}_2\text{TeO}_4$ . In combination with hydrogen or metals of the sulfur group it forms tellurides such as hydrogen telluride,  $\text{H}_2\text{Te}$ , and silver telluride,  $\text{AgTe}$ . Tellurium is used in the manufacture of rectifiers and crystal detectors in various forms of wireless equipment, and together with other organic substances, is employed in anti-knock compounds for gasoline. It is also used to a limited extent for imparting a blue color to glass.

**TELLUS** or **TELLUS MATER**, in Roman religion, an ancient divinity of the fields, who, as coworker with Ceres (q.v.), goddess of grain, brought to maturity the seed. Hence Tellus was considered a goddess of marriage and fertility. She was later identified by the Romans with the Greek goddess of the earth, Gaia (q.v.).

**TELPHERAGE**, a form of cableway transportation in which the supporting grooved-wheel trolleys or trucks are equipped with electric motors, so that each unit is self-propelling.

**TELUGUS**, or **TELINGAS**, the northeastern division of the Dravidian family in southern India, numbering over 23,000,000. The Yanadis of Nellore, considered by some authorities to be the primitive Telugus, both with respect to physical characteristics and general culture status, are markedly dolichocephalic, broad-nosed, short-statured, and dark-skinned. The castes of the Telugus, adopted through Hindu influence, run down from the Brahmans to the despised Madigas, who are leather workers.

**TEMME**, **JODOCUS DONATUS HUBERTUS** (1798-1881), German criminologist, politician, and novelist, born in Lette, Westphalia, and educated at the universities of Münster

and Göttingen. He became vice-president of the Provincial Court of Appeals at Münster in 1848. His attitude as a leader of the extreme left in the Prussian as well as in the German National Assembly involved him in a trial for high treason, and, although acquitted, he was dismissed from government service in 1851. In the following year he accepted the professorship of criminal law at Zurich. Temme was best known as the author of more than 150 novels and stories, artistically of little importance, dealing with criminal schemes; these works include *Deutsche Kriminalnovellen* (1858-59), *Kriminalnovellen* (10 vols., 1860-64), *Dunkle Wege* (1862), *Schwarzort* (1863), *Die Heimat* (1868), and *Die Generalin* (1877).

**TEMPE**, a town of Maricopa Co., Ariz., situated on the Gila R., about 8 miles E. of Phoenix. The town is the site of Arizona State Teachers College, a coeducational institution founded in 1885. Pop. (1950) 7684.

**TEMPE**, a mountain gorge in Thessaly, Greece, extending for almost 5 m. between the precipitous sides of the mountains Olympus and Ossa (qq.v.). Through it the Salambria River (anc. Peneus) rushes to the sea. At places the rocky walls recede, leaving space for small glades and openings. From earliest times the vale of Tempe was praised in song for its beauty, and was celebrated as one of the favorite haunts of the god Apollo. In one of the glades stood a temple of Apollo, to which every eight years an embassy made a pilgrimage from Delphi (q.v.) to pluck the laurel for the Pythian Games (q.v.). The defile was a main route to Macedon and was of great strategic importance, as much as it could be defended by a small force of soldiers.

**TEMPER**. See IRON, METALLURGY OF; TEMPERING; ANNEALING.

**TEMPERAMENT**, a term employed in physiology ever since the time of Galen, to designate certain physical and mental characteristics presented by different persons. The four cardinal humors of ancient physicians were the sanguine (blood), choleric (yellow bile), phlegm, and melancholic (black bile).

**TEMPERAMENT**, in music, a system of compromise in the tuning of keyed instruments. Though the various intervals of the scale are spoken of broadly as consisting of tones and semitones, the successive tones are not all equal when given in just intonation according to harmonic law, i.e., so that

the consonant intervals are in perfect tune and as every note in the scale may become the keynote of another scale, if all these scales are to be given exactly, a complete set of keys for each would be necessary. The present practice, known as *equal*, makes each tone and semitone in the octave approximately equal, so that every key is equally available; while at the same time every interval except the octave deviates slightly from just intonation.

**TEMPERANCE**, primarily, a moderate use and enjoyment of all good things. In modern days the word is often used to designate great moderation in using alcoholic beverages, or even total abstinence from them.

Organized temperance sentiment, as it is understood today, had its origin in the United States and in Great Britain early in the 19th century. By 1830, organizations in the former country numbered over 100,000 members, and in the latter some 3500 members. Numerous societies having a common aim had developed in the United States by 1865, and at that time a movement spread toward their consolidation into the National Temperance Society and Publication House, a nonsectarian and nonpartisan society, advocating total abstinence. This society published and distributed pamphlets, textbooks, and papers, held public meetings, and called national and international conferences. In 1868 political parties were organized in Illinois and in Michigan, and these led, in 1869, to the organization of the National Prohibition Party. In 1874 the Woman's Christian Temperance Union, one of the strongest factors in the development of the total abstinence movement was organized as a result of the Women's Crusade.

Sentiment spread with rapidity. Although the Prohibition Party never acquired much numerical strength, its influence was felt by both major political parties, necessitating more careful scrutiny of the characters of their respective candidates, especially in local elections. But the greater accomplishment of the several temperance organizations was in the collection of economic facts regarding overindulgence in alcoholic beverages. As a result of the latter, plus individual independent research, by 1917 many of the railroads had followed the lead of the Pennsylvania System in adopting ironclad regulations prohibiting the use of intoxicating liquors by employees under penalty of discharge; and a large and influential group of industrial concerns had adopted similar rigid rules.

Mercantile and business houses found that many transactions, such as wholesale selling, which hitherto had been accompanied by excessive drinking, could be conducted on a temperance basis. For developments since 1918, see PROHIBITION.

#### TEMPERANCE LEAGUE OF AMERICA.

See ANTI-SALOON LEAGUE OF AMERICA.

**TEMPERA PAINTING**, in art, a method of painting in which the pigment is carried in an egg, casein, gum, or glycerine solution in water. The process of painting in tempera is the oldest method of painting known to mankind; the wall paintings of ancient Egypt and Babylon, and of the Mycenaean period in Greece were probably executed in tempera with a medium of yolk of egg, to which, sometimes, a little vinegar was added. The use of tempera subsequently became widespread throughout Europe and reached its height in Italy. The ground upon which the 13th-century Florentine painters Giotto, Cimabue, and their contemporaries painted was usually plaster of Paris, known as "gesso". The method of preparing a panel was first to fill all the cracks and crevices in a poplar, lime, or willow panel with a mixture of size and sawdust. The panel was then covered with a piece of fine linen cloth, which was kept in place with size, and this surface was coated with heavy gesso, known as *gesso grasso*. Finally, a lighter gesso coating called *gesso sottile*, which provided the painting surface, was laid on with a brush.

As the surface was very absorbent, the painter was forced to work with great rapidity and sureness. The Italian painters of the Renaissance ground their colors by hand and mixed the powdered colors with the medium. Today, however, tempera paints are prepared in tubes and pots, requiring only the addition of water or of some other medium, usually casein. Owing to the fact that the colors are opaque, tempera paints may be applied to a dark ground with great effectiveness. The tempera medium has always proved attractive to artists. It is now frequently employed in commercial art, because it produces colors which are more vivid than those obtainable in either oil or water color, and provides a "mat" or flat surface, without prominent highlights, which lends itself well to photographic reproduction.

**TEMPERATURE**, the thermal condition of a body which determines the interchange of heat between it and other bodies. Our first ideas of temperature are derived from our

sensations of hot and cold. The effect of adding heat to a body is to make it hotter, unless it is at its melting or boiling point (see **HEAT**). This rise of temperature is accompanied by volume changes, on which the more usual methods of measuring temperature depend (see **THERMOMETER**). A scientific measure of temperature should be independent of any particular substance, and should depend solely upon the fundamental properties of heat itself. This absolute measure of temperature was first given by Lord Kelvin (Sir W. Thomson), who based his system on Carnot's thermodynamic cycle (see **THERMODYNAMICS**).

In meteorology, the distribution of land and sea influences the distribution of temperature to a very great extent. In January the great land areas in the Northern Hemisphere are much colder than the ocean areas at the same latitude; in July this relation is reversed. The earth's surface temperature must be an important factor in determining the mean temperature of the air. The periodic changes in the atmospheric air are due mainly to the sun's radiation heating up the solid parts of the earth. Consequently the temperature falls as we ascend in height. Up to the highest accessible altitudes the fall in temperature is fairly steady as the height increases.

**TEMPERATURE OF THE BODY.** The temperature in the healthy human adult averages from 98.4° to 98.6° F., but 97.5° and 99° F. are within normal limits. In the newborn child the temperature is slightly above the average, as it is in old age. Race has but a slight influence, a difference of 0.20° F. being observed between the nations of southern Europe and those of the northern part. The temperature rises slightly after a meal and during exercise. During the day the body heat varies about half a degree, being highest between 5 and 8 P.M. and lowest between 2 and 6 A.M.

**TEMPERING**, a low-temperature process in the heat treating of steel by which a desirable balance is obtained between the hardness and toughness of the finished product. In the strict sense, tempering must be distinguished from annealing (q.v.), a process of softening and toughening, and from hardening, which is accomplished by heating the steel to red or white heat and then cooling it suddenly by quenching it in a cold liquid such as water or oil. Tempering involves a limited measure of both processes: steel articles which have been annealed to render them soft enough for filing

or machining must be made harder; tools made by a process such as forging (q.v.) are hardened in the process and must be toughened before they can give satisfactory service. The proper balance between hardness and toughness is controlled by the temperature to which the metal is heated before being quenched. The temperature is measured by means of pyrometers or by observing the color of the oxide film formed on the metal during heating. Razors, for example, are heated to about 220°C (450°F.), as indicated by a pale straw color on the metal; shears and scissors, to 254°C (490°F.), indicated by brown; wood-working tools to 276°C (530°F.), indicated by purple, and swords and springs to 293°C (560°F.), indicated by dark blue. Non-ferrous metals and alloys are usually tempered by cold working, such as sheet rolling and wire drawing the degree of hardness being proportional to the reduction in the thickness of the metal produced by the process.

**TEMPEST**, DAME MARIL (MARY SUSAN) (1866-1942). English actress, born in London. Her first appearance on the stage was at the Comedy Theatre, London, in 1885, as Fiametta in *Bohaccio*. Some of her best-known parts were Polly Eccles in *Caste*, Peggy O'Mara in *All of a Sudden Peggy*, Becky Warder in *The Truth*, and Kitty in *The Marriage of Kitty*. She visited America in 1890, playing Kitty Carroll in *The Red Hussar* at Palmer's Theater, New York. She also became well known as a producer after 1911.

**TEMPEST, THE**, a romantic comedy in four acts by William Shakespeare, probably written in 11, and first published in the edition of 2. Shakespeare's plays known as the First Folio (1623). The setting of the play is an island in the southwest Atlantic Ocean. Prospero, the rightful Duke of Milan, driven from his throne by his wicked brother Antonio in collusion with the King of Naples, is set adrift on the sea with his young daughter Miranda. Father and daughter are at length cast upon a wild and desolate island, to which the witch Sycorax had formerly been banished. During her period of banishment, Sycorax had made Ariel, a gay and mischievous sprite, a prisoner on the island for his refusal to execute her commands. Through his knowledge of magic, Prospero releases Ariel and other spirits enchanted by the witch. These spirits now acknowledge Prospero as their master, as does Caliban, the deformed and cowardly son of Sycorax.

Twelve years later, Prospero, by means

of magic, causes a ship bearing his brother Antonio, the King of Naples, and the latter's son Ferdinand to be wrecked on the island. All lives are saved, but Ferdinand, who has become separated from the other passengers, thinks that they have drowned, and is in turn thought by them to have drowned. Prospero contrives to bring Ferdinand and Miranda together, whereupon the two young people fall in love and resolve to marry. Meanwhile, at Prospero's command Ariel inflicts a multitude of discomforts upon Antonio and the King of Naples. Antonio is reduced to submission. The king, remorseful over his cruelty, is forgiven by Prospero, and his son is returned to him. Prospero thereupon magically restores the wrecked ship to seaworthy condition, renounces his supernatural powers, and prepares to leave the island with the others. Caliban, whose scenes with Stephano, a drunken butler, and with Trinculo, a jester, furnish some of the most delightful comedy in the play, remains behind as the sole inhabitant of the island.

**TEMPLAR, KNIGHTS**, a religious and military order of the Middle Ages, the great rival of the Knights of St. John of Jerusalem. In 1119 Hugues de Paynes and Geoffrey de Saint-Ad  mar (Saint-Omer), with six companions, formed a military band to protect pilgrims in Palestine. They adopted a monastic rule, and took the name Knights of Christ. But as quarters were assigned to them in the palace at Jerusalem, known as Solomon's Temple, they soon were called Knights of the Temple, or Knights Templar (*milites templi*). In 1128 at the Council of Troyes a rule, inspired by St. Bernard, and closely following the Cistercian, was given them.

The capital of the order was in Jerusalem till 1187, and then successively in Antioch, Acre, and C  sarea, and after the extinction of the Christian power in Syria (1291), in Cyprus. Their standard, called *Beau  lant*, was half black, half white, with the motto *Non nobis Domine*. The Templars' wealth, pride, and power brought them into conflict with church and state. In March, 1312, Clement held a secret consistory which decreed suppression for the order. Its property went to the Hospitalers.

**TEMPLE**, a building consecrated to religious worship, especially among pagan peoples. The term is also applied to the chief sanctuary of the Jews (see **TEMPLE AT JERUSALEM**), to Christian churches belonging to the Knights Templar, and in France to

Protestant places of worship. It is also applied to the meeting places of certain Masonic bodies, and to buildings having the form or character of an antique temple. A temple was usually dedicated to some deity, whose image it contained; the interior was accessible to priests, but not to the general body of worshippers. Among most ancient peoples the temple was the principal architectural feature, as in Greece, where the history of temple construction is practically the history of architecture. The subject is therefore best treated under the general title **ARCHITECTURE**, and in the articles on the several countries. In general, it may be observed that the ancient temples (excepting those of Chaldea-Assyria) had these elements in common: a sanctuary containing the effigy or some other sacred symbol of the deity or deities worshiped; colonnades to shelter worshippers outside the sanctuary; one or more courts or enclosures with important gateways, and sometimes such adjuncts as a lake, grove, fountain, or well sacred to the deity. The Pantheon in Rome was dedicated "to all the gods". Temples of fame are a modern product; these include the Walhalla near Ratisbon, the Ruhmeshalle at Munich, and the Temple of Fame of the University of New York, which is really an open colonnade. See **HALL OF FAME**.

**TEMPLE**. See **INNS OF COURT**; **TEMPLARS**.

**TEMPLE**, a city of Bell Co., Tex., situated 72 miles N.W. of Austin. It is served by two railroads and maintains a municipal airport. The city is an important shipping point and manufacturing center, and has a large wholesale trade in cereal grains. Agricultural products in the surrounding area include, besides grain, cotton, pecans, peaches, blackberries, dairy products, cattle, hogs, horses, mules, goats, and sheep. Temple contains extensive railroad repair shops, an iron foundry, cotton gins and compresses, flour mills, and factories manufacturing school equipment, rock wool insulation, marble and granite products, tools, toys, brooms, cotton goods, and bedding. The city is the site of Temple Junior College, established in 1926, of the U.S. Soil Erosion Experiment Farm, of the State Blackland Experiment Station, and of the annual Central Texas Fair. In addition, Temple is a noted medical center, containing several prominent medical institutions, notably the Scott and White Hospital and McClosky Veterans Hospital. The city was founded in 1881 and chartered in 1884. Pop. (1950) 25,467.

**TEMPLE, FREDERICK** (1821-1902), archbishop of Canterbury, born in Leukas, Ionian I. Successively principal of Kneeler Hall Training College, inspector of schools, and head master of Rugby, he became conspicuous in 1860 as author of the first of the *Essays and Reviews*. In 1868-70 he supported the disestablishment of the Irish Church, and was in 1869 consecrated bishop of Exeter. He proved an able administrator, and in 1885 was promoted to the see of London and in 1896 was made archbishop of Canterbury.

**TEMPLE, RICHARD GRENVILLE**, 1st EARL OF (1711-79), British statesman. He is remembered chiefly as having served under the elder Pitt from 1752 to 1761 and as having broken with Pitt (Chatham) on the Stamp Act in 1766, after which he retired from public affairs.

**TEMPLE, SIR WILLIAM** (1628-99), English diplomatist, statesman, and essayist. He married Dorothy Osborne in January, 1655, and was returned for Carlow to the convention parliament at Dublin in 1660. In 1665 he was made resident at the court of Brussels. His most important success was the treaty of 1668, known as the Triple Alliance, by which England, Holland and Sweden united to curb the schemes of France. Temple also took part in the Congress of Aix-la-Chapelle (May, 1668), and was appointed ambassador at The Hague. In 1677 he assisted in bringing about the marriage of the Prince of Orange with Princess Mary. Charles II accepted his constitutional remedy of a reformed privy council of thirty persons.

The remainder of his days Temple devoted to letters and to gardening. The king occasionally consulted him, and for a time Jonathan Swift was his secretary.

**TEMPLE, WILLIAM** (1881-1944), British prelate. He was ordained in 1903 and became chaplain to the archbishop of Canterbury and headmaster of Repton School (1910-14). The following years were spent in London as rector of St. James's, Piccadilly (1914-18), and as canon of Westminster (1919-21). He was bishop of Manchester (1921-29) and archbishop of York (1929-42). In 1942 he became archbishop of Canterbury. He was editor of *The Challenge* (1915-18) and *The Pilgrim* (1920-27). His writings include *Christus Veritas* (1924); *Christ in His Church* (1925); *Personal Religion and the Life of Fellowship* (1926); *Essays in Christian Politics* (1927); *Christianity and the State* (1928); *Christian*

*raith and Life* (1931); *Thoughts on Some Problems of the Day* (1931); *Nature, Man and God* (1934); *Readings in St. John's Gospel* (1939); and *Daily Readings* (1950).

**TEMPLE AT JERUSALEM**, the sanctuary erected by Solomon (about 993-953 B.C.) on the eastern hill, between the Tyropæon and Kidron valleys, N. of the original city of David on the Ophel hill, and opposite the Mount of Olives. According to 2 Chron. 3:1 it was built on the threshing floor which David had bought from Ornan the Jebusite.

Solomon's temple was destroyed by Nebuchadrezzar in 586 B.C. and was rebuilt by 516 B.C., with the permission of Darius Hystaspis, desecrated by Antiochus IV Epiphanes, dedicated to Zeus in 168 B.C., but rededicated to Yahwe in 165 B.C. Both the first and second edifices, were, however, surpassed in architectural splendor by the third temple, begun by Herod in 20 B.C. and completed in 64 A.D.

The area of the temple terrace was greatly enlarged by new substructures built with masonry of colossal magnitude. Marble was profusely used for colonades, gates, and walls, and the magnificence of Roman carved decoration and architectural detail was blended with the Oriental arrangement essentially like the two preceding structures. This temple, from which Jesus expelled the money changers and merchants, was destroyed during the pillage of the city by Titus in 70 A.D., but contrary to his orders. After the inscription of Simon Bar-kokba (q.v.) had been quelled an altar or shrine seems to have been erected in its place to Jupiter Capitolinus by Hadrian, in front of which were two statues of the emperor, at least one of them equestrian. On the temple area, Abd el Melck, who reigned from 685 to 705, ordered that a splendid mosque, the *Kubbet el Sakhrak*, or Dome of the Rock, be erected. This is commonly known as the Mosque of Omar.

**TEMPLE BAR**, a London gateway, dividing Fleet Street from the Strand, the city from the shire. Rebuilt after the Great Fire by Wren, 1669-73, it was removed in 1878-79, and re-erected in Theobalds Park, Hertfordshire, in 1888.

**TEMPLEMORE**, a town of County Tipperary, Ireland, which takes its name from a commandery of the Knights Templar, and is situated on the river Suir, 8 miles N. of Thurles. Pop., about 3000.

**TEMPLETON**, town of Worcester Co., Mass. It has manufactures of furniture, tin

goods, and children's toys. Pop (1950) 4757.

**TEMPLE UNIVERSITY**, a coeducational, nonsectarian institution of higher learning, situated at Philadelphia, Pa. It was founded in 1884 as Temple College by the Baptist Temple in Philadelphia; the present name was adopted in 1907. During its first seven years the College offered only evening classes for men, and was intended primarily for those whose occupations prevented them from attending regular daytime schools. Evening classes are still held in all departments except medicine and dentistry. Courses leading to bachelor's, master's, and doctor's degrees are offered in the liberal and fine arts, sciences, theology, law, medicine, pharmacy, dentistry, music, chiropody, commerce, education, and nursing. An accelerated program of two years and six months, leading to the bachelor's degree, is also available. In 1947-48 a Community College and Technical Institute were added to the University to provide two-year training programs in management and labor service. In a recent year the enrollment was nearly 17,500 and the faculty numbered about 970, the library included about 323,000 volumes.

**TEMPO**, the degree of rapidity with which a piece of music is to be executed. The rhythmical proportions of notes, as indicated by their form, give them only a relative value, and have no reference to the absolute speed at which the entire composition is to be played. The varying rates of speed at which different compositions or their divisions are to be played are usually indicated by certain terms called *tempo marks*. These terms are not always used with exact precision, and sometimes apply more to the character than to the absolute speed of performance. The following are the most common terms, in the order of increasing speed: *Grave*, *Lento*, *Largo*, *Adagio* (slow); *Andante*, *Moderato*, *Allegretto* (moderate), *Allegro*, *Vivo* (*vivace*), *Presto* (fast). Gradual increase in speed is indicated by *accelerando*, *stringendo*; gradual decrease by *rallentando*, *ritardando*.

**TEMPORALISM**, in philosophy, a term coined to designate a philosophic system which lays emphasis on the fundamental character of time in the constitution of the universe, as opposed to the philosophies which slur over or deny the validity of time, such as the philosophies of Spinoza and the Hegelians.

**TEMUCO**, capital of Cautin Province, Chile, on the Cautin River, in the s. of the

State, 80 miles NNE of Valdivia. It has tanneries and breweries. Pop., about 42,000.

**TENACITY**. See **TENSILE STRENGTH**.

**TENAFLY**, borough of Bergen Co., N.J., on the Hudson River, 15 miles N. of Jersey City. It is a residential and summer resort. Pop (1950) 9651.

**TENAILLE**, in fortification, a low work situated in the re-entering angle formed in the enceinte ditch by the curtain and flank of the bastioned system. It is isolated from these parts of the enceinte by a ditch, and is designed to serve as a mask, protecting the scarp walls of this re-entering angle from fire, as well as the outlets to the enceinte ditch. A tenailed line, the re-entering angles of which are between 90 and 100 degrees, and the salient angles not less than 60 degrees, forms a tenailed system. See **FORTIFICATION AND SIEGE CRAFT**.

**TENANCY AT SUFFERANCE**. See **TENANT**.

**TENANCY AT WILL**. See **TENANT**.

**TENANT**, in the law of property in England and the United States, the owner of an interest in an estate, or the occupier of property of another, called a landlord. Tenancies that involve ownership of property may be joint, in common, or by the entirety. Joint tenancy of real or personal property arises when two or more parties acquire the property at the same time, under the same deed or will, have identical interests in the property, and are individually entitled to the common possession of the entire property. In a joint tenancy the interest in the property of a tenant who dies passes to the survivor or survivors, the right to a joint tenant's interest is designated the right of survivorship. A tenancy in common arises when real or personal property is conveyed or devised to two or more persons, the instrument specifically giving to each tenant a specific, undivided interest in the property, the interests of each tenant need not be equal or acquired by the same instrument. In the United States, the statutes of most States provide that a conveyance or devise to two or more persons creates a tenancy in common unless such conveyance or devise is expressly made to them jointly. A tenancy by the entirety arises when property is conveyed to a husband and wife jointly, or when one spouse conveys the property to himself and the other spouse; a tenancy by the entirety can apply only to real property. The right of survivorship



exists as to estates by the entirety; upon the death of either spouse, the survivor takes the whole estate. Divorce or annulment of a marriage changes a tenancy by the entirety to a tenancy in common.

Tenancies that involve occupancy of property under a landlord-tenant relationship are classified as tenancy for years, tenancy from year to year, tenancy from month to month, tenancy at sufferance, and tenancy at will. See LEASE; LANDLORD AND TENANT.

**TENASSERIM**, the southernmost division of Burma. It is a long narrow strip of territory, 500 m. long by 40 to 80 m. broad between the sea and the mountains of the Siamese frontier. Area, 37,614 sq m; pop., about 1,800,000.

**TENCH**, a genus of fishes found in continental Europe, of the Carp family, Cyprinidae, represented by a single species, *Tinca vulgaris*. The thick body is covered with small scales and abundant mucus.

**TENCIN**, CLAUDINE ALEXANDRINE GUÉRIN DE (1667-1749), French writer, born in Grenoble. In 1714 she came to Paris, where her wit and beauty attracted many lovers, among them the Regent and Cardinal Dubois. She had much influence, was an enemy of the Jansenists, and enriched herself and helped the fortunes of her brother Cardinal Pierre Guérin de Tencin (1680-1758). Her romances, *Mémoires du Comte de Comminges* (1735), *Le Siège de Calais* (1739), and *Les Malheurs de l'Amour* (1747), show passion and style, with all the 18th-century limitations. Madame de Tencin's *Comtesse de Pondeval* with her brother appeared in Paris in 1790.

**TEN COMMANDMENTS**. See DECALOGUE.

**TENDAI-SHU**, a sect of Japanese Buddhists, established toward the end of the 8th century by a Japanese priest named Dengyo Daishi. Like all Japanese sects, it is of the Northern School, and is based upon the *Saddharma Pundarika*, ("Lotus of the Good Law"). Salvation lies in the perception of the original and absolute Buddha, of whom the historic Buddha is one manifestation. The means of salvation are meditation and wisdom. The sect provides an exoteric teaching for the vulgar, while esoteric doctrines are reserved for the monks; the highest truths, however, are recognized as transcending human comprehension. The sect is eclectic, and various Buddhas are worshiped in its temples. It completed the triumph of Buddhism in Japan by declaring

that the Shinto deities were manifestations of Buddha. As it attempted to reconcile contradictory principles, it gave rise to schism and was the mother of many sects. Its center was on the mountain near Kyoto called Hiei-zan. Its priests, though devoted by profession to meditation, became very warlike in the Middle Ages. Nobunaga (q.v.) in 1571 A.D. destroyed the monastery, and killed the inhabitants. The sect never regained its commanding position.

**TENDENCY**, in psychophysics, a term denoting the nervous disposition which underlies some phase of mental constitution.

Tendencies are either natural, i.e., based on inheritance and transmitted through the nervous system, or they are acquired during the lifetime of the organism.

**TENDER**, in law, an offer to perform a contractual obligation. The term is used most frequently to refer to an offer to pay money in satisfaction of a debt or the offer of the amount due on a contract of sale. The obligation may, however, call for the performance of an act other than the payment of money such as the delivery of goods to a purchaser by a seller at a specific time and place; delivery in conformity with these conditions is considered a tender of performance.

An obligation calling for the payment of money can be discharged by an offer of legal tender (see below) by the debtor to the creditor. Tender must be made at the time specified for performance of the obligation. Thus an obligation by a tenant to pay rent under a lease, or the obligation of a debtor to pay interest on a promissory note, will be discharged only if the tender is made on the due date. The tender must be unconditional, that is, the debtor must offer what is due without attaching any conditions to his payment.

In the United States prior to 1933 legal tender included gold coins, gold certificates, United States notes (greenbacks), U.S. Treasury notes of 1890, silver dollars, and copper and nickel coins up to twenty-five cents; if a contract called for payment in gold it could be satisfied only if gold or gold certificates were tendered in payment. By Congressional resolution of June 5, 1933, following the enactment of legislation reducing the gold content of the dollar from twenty-five grains of gold to fifteen grains, obligations giving an obligee the right to require payment in gold were declared to be against public policy. The resolution provided further that

"every obligation. . . shall be discharged upon payment, dollar for dollar, in any coin or currency which at the time of payment is legal tender for public or private debts". Under Article I, Section 10, of the U.S. Constitution, a State may make only gold and silver coin legal tender in payment of debts. Ordinary bank notes and U.S. silver certificates are not legal tender. Tender of a check in payment of a debt may be refused by a creditor, inasmuch as it is not legal tender.

In legal pleading a plea of tender by a defendant in an action for the payment of money is a statement that he admits the debt due, that he has offered payment to the plaintiff before the action has been instituted, and that he brings the money into court for payment to the plaintiff. Money paid into court pursuant to such a tender becomes the property of the plaintiff. The plaintiff may accept the tender after he has instituted the action, or may refuse the tender and proceed with his action. If he accepts the tender his action is dismissed without costs being assessed against the plaintiff; if he proceeds with the action the money constituting the tender is applied to any judgment he recovers.

**TENDON**, the white fibrous tissue or sinew reaching from the end of a muscle to bone or some other structure which is to serve as a fixed attachment for it, or which it is intended to move. Tendons have been divided into three categories: (1) *funicular*, or ropelike, as the long tendon of the biceps muscle of the arm; (2) *fascicular*, as the short tendon of that muscle, and as the great majority of tendons generally; and (3) *aponeurotic* or tendinous expansions, sometimes of considerable extent, and serviceable in strengthening the walls of cavities, as, for example, the tendons of the abdominal muscles.

**TENDON OF ACHILLES**. See **ACHILLES TENDON**.

**TENDRIL**, in botany, a slender, sensitive organ found on all climbing plants, and serving to support the stem of the plant, usually by winding around some external object. A tendril may consist of a modified stem, as in the grape (q.v.); a modified leaf, as in the pea (q.v.); an axillary branch, as in the passionflower (q.v.); or a stipule, as in the greenbrier (see **SMILAX**). Some plants, such as the Virginia creeper, have tendrils modified by development, at the tips, of suction cups which attach themselves to smooth surfaces.

**TENEBRÆ**, a service in the Roman Catholic Church held upon Good Friday, as well as on the preceding two days. It consists of the matins and lauds of the following day, and differs from other services in that, by the close of the service, all the lights in the church have been gradually extinguished except one, which for a time (as a symbol of our Lord's death and burial) is hidden at the Epistle corner of the altar.

**TENEMENT-HOUSE LAW**, the name by which are known various laws passed by municipalities in an effort to prevent unhealthy congestion and population. Perhaps the best known of these is the New York Tenement House Law of 1901, sometimes known as the "New Law".

**TENERANI**, **Pietro** (1789-1869), Italian sculptor, born in Torano, near Carrara, and trained at the Carrara Academy and later in Rome under the Danish sculptor Bertel Thorvaldsen (1768-1844). Tenerani was appointed professor at the Academy of St. Luke and was the leader of Roman art during the middle of the 19th century. His work is in the classicist style and is characterized by dignity, refinement, and harmony of line. Among his best known sculptures are the group "Cupid and Venus" (Chatsworth), the bas-reliefs of "Charity" (Castle Ashby Church, Northamptonshire); the "Deposition from the Cross", in the Lateran (Rome); an "Angel of the Resurrection", in Santa Maria sopra Minerva (Rome); replica in the Friedenskirche, Potsdam; and the tomb of Pius VIII in St. Peter's. He was one of the first Italian sculptors to use modern costume for his fine portrait statues, which include those of the South American statesman Simón Bolívar (Columbia, South America) and of the Italian statesman Count Pellegrino Rossi (Carrara).

**TENERIFE** or **TENERIFFE** (anc. *Pintuaria*), the largest of the Canary Islands, situated in the Atlantic Ocean about 175 miles n.w. of Cape Bojador, Africa, and forming part of Santa Cruz de Tenerife Province, Spain. The island extends about 60 m. in a north-east-southwest direction and ranges between 30 m. and 10 m. in width. Massive Pico de Tenerife, also known as Teyde or Teide, occupies the main portion of the island. A dormant, cone-shaped volcano which attains a height of 12,192 ft., Pico de Tenerife is surmounted by two craters. Chahoria, the largest of craters, has a diameter of 4000 ft. and a depth of about 150 ft. On the n.w., n., and n.e., the base of the uplift consists



FIG. 1. Tourist Office

*Windmill on a hillside of Tenerife, largest of the Canary Islands*

is generally level upland. A rugged ridge with elevation up to 8000 ft. extends around the remainder of the base. Much of the terrain between the ridge and the sea is composed of tablelands. The narrow peninsula of Tenerife is occupied by a range of mountains of which Izaña (7374 ft.) and Pico de Teide (6027 ft.) are the highest peaks.

Excluding the more elevated areas, Tenerife possesses a dry, subtropical climate which is modified by oceanic influences. Temperate conditions prevail on the higher mountain slopes and during the winter months the summit of Pico de Teide is now covered. The vegetation, especially below 4000 ft. is luxuriant and diversified. Many tropical plants, including the date palm, coffee plant, and banana tree, flourish between sea level and the 1300 ft. level. Noteworthy among the indigenous trees of this belt is the Dragon Tree (qv). Various species of laurel, oak, olive, myrtle, and buckthorn are found between the 1800 ft. and 4000 ft. level.

The belt between 4000 ft. and 4500 ft. abounds with pine trees. Species of wild flowering plants on the island total more than 800.

Agriculture and fishing are the chief industries of Tenerife. In terms of value bananas are the leading crop. Besides coffee and dates other major crops include sugar cane, oranges, onions, potatoes, tomatoes, cotton, and grain. Because of the general aridity, farming enterprises are largely dependent on irrigation.

Santa Cruz de Tenerife (qv) the administrative center of the province is the largest town and principal seaport of Tenerife. The next largest town is Iguina (qv). For additional information concerning Tenerife, see CANARY ISLANDS. Area of island 2035 sq. m., pop. (1950) 442,380.

**TENERIFE, PEAK OF,** or PICO DE TEIDE, a famous dormant volcano, the highest summit in the Canary Islands, situated in the southwest of the island of Tenerife, 12,192 ft. above sea level.

**TENERIFFE.** See **CAVARY WIND**.  
**TENGCHUNG**, formerly **TENGYUEH** or **MOMEIN**, town of Yunnan Province, China, 60 miles from the border of Burma and about 275 miles w.s.w. of Kunming, or Yunnanfu, the capital of the province. The town lies between the valleys of the Salween and Irrawaddy rivers, at an altitude of 5400 ft. above sea level. The region of Tengyueh was captured from the Shan States by the Chinese in the 14th century, at which time the town of Tengyueh was established and fortified as a Chinese outpost. It was an important trading station on the route from the present Kunming to Bhamo, a trading center of N. F.irma. In 1897 Tengyueh became one of the treaty ports opened to foreign trade by agreement of the Chinese government with various European nations. In 1942, during World War II, Tengyueh was captured by the Japanese; it was recaptured in Sept., 1944, and in Jan., 1945, a newly constructed road between Myitkyina, in Burma, and Tengyueh was opened by the Allies. At the end of 1949 Tengyueh was occupied by the Chinese Communists. Pop., about 19,000.

**TENIERS, DAVID**, known as **THE ELDER** (1582-1649), Flemish painter, born in Antwerp. His subjects are homely, the interiors of public houses, rustic games, weddings, and the like.

**TENIERS, DAVID**, known as **THE YOUNGER** (1610-90), son of the preceding, born in Antwerp. He had the favor and friendship of the archduke Leopold William, Don Juan, natural son of Philip IV of Austria, the Prince di Orange, the Bishop of Ghent, and other dignitaries. He was admitted "master" of the guild of St. Luke in 1632, and in 1644 was elected its president.

**TENISON, THOMAS** (1636-1715), Archbishop of Canterbury, born in Cottenham in Cambridgeshire. He was made bishop of Lincoln by William III in 1691, and primate of all England three years later. He held many important state offices, and attended Queen Mary and King William on their deathbeds. He crowned Queen Anne and King George I, being a strong supporter of the Hanoverian succession.

**TEN KATE, JAN JACOB LODIEWIJK**. See **KATE, JAN JACOB LODIEWIJK TEN**.

**TENNANT, CHARLES** (1768-1838), British chemist, born in Ochiltree, Scotland. He became interested in the chemistry of bleaching, and discovered that, by passing chlorine gas into a suspension of lime in water, he

obtained a product possessing properties similar to those of javelle water, which was then generally used as a bleaching agent. The new product was found to be much the cheaper. He was given a patent for his process in 1798, but was unable to protect it against frequent infringement. Later he patented a process for making bleaching powder by passing chlorine over slaked lime, a method that is still in commercial use. In 1800 he founded the St. Rollox Chemical Company in Glasgow.

**TENNANT, SMITHSON** (1761-1815), English chemist, born in Selby, Yorkshire, and educated at Edinburgh and Cambridge universities. Devoting himself to scientific investigation, especially in agriculture and chemistry, he discovered the element iridium in 1803, and osmium in 1804, which he found in the residues obtained in the purification of platinum ores, he also contributed to the proof of the chemical identity of the diamond and charcoal; see **CARBON**. In 1813 he became professor of chemistry at Cambridge University, but delivered only one series of lectures, being killed in the accidental collapse of a bridge.

**TENNANT, WILLIAM** (1784-1848), Scottish poet, born in Anstruther, Fife-shire. In 1812 he published his *Anster Fair*, notable as the first attempt to naturalize in the English language the gay *ottava rima* of the Italians, soon afterward adopted by Byron in his *Beppo* and *Don Juan*. His attainments as a linguist were extraordinary, and in 1835 he was appointed to the chair of Oriental languages in the University of St. Andrews.

**TENNANTITE**. See **TETRAHEDRITE**.

**TENNENT, DAVID HILT** (1873-1941), American zoologist, born in Janesville, Wis. He was lecturer in biology (1904-05), associate (1905-06), associate professor (1906-12), and professor at Bryn Mawr College, 1912-38. Tennent was a member of various expeditions of the Carnegie Institution to the West Indies, Australia, and Japan. His published work was on the development of parasitic worms and experimental studies on hybridization of echinoderms. In 1920 he was elected a member of the National Academy of Sciences.

**TENNENT, GILBERT** (1703-64), American Presbyterian minister, born in County Armagh, Ireland. He held pastorates in New Castle, Del., New Brunswick, N.J., and Philadelphia, Pa., and on the occasion of Whitefield's visit to America was prominently associated with the great evangelist.



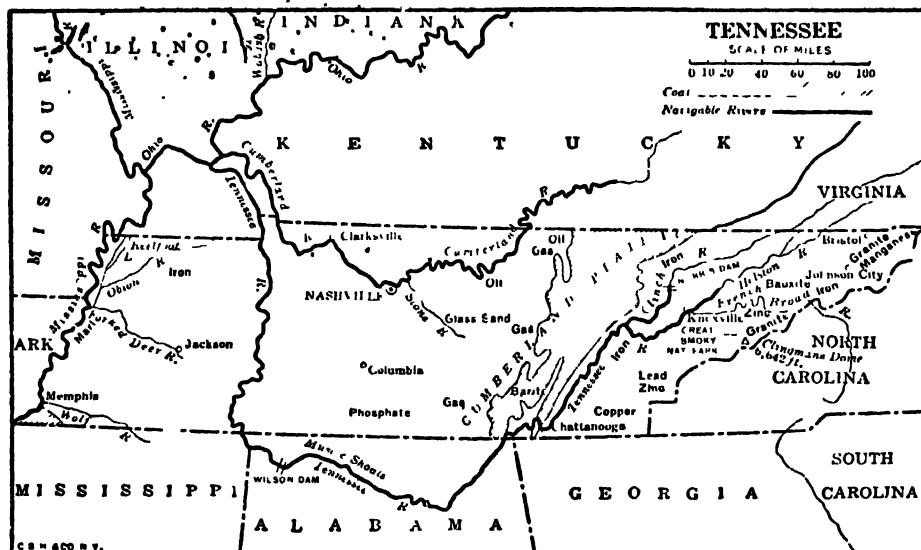
Paul A. Moore, Tennessee Conservation Dept

*Tennessee State Capitol in Nashville*

A man of very pronounced opinions and eccentric manners, his life was rife in controversy. He was one of the delegates sent to Europe in 1753 to solicit help to found Princeton University.

**TENNESSEE**, one of the South East Central States of the United States, bounded on the n. by Kentucky and Virginia, on the e. by North Carolina, on the s. by Georgia, Alabama, and Mississippi, and on the w. by the Mississippi R., which separates the State from Arkansas and Missouri. Tennessee ranks as the 33rd State in the Union in area, 16th in the order of population (1950), and 16th in the order of admission, having entered the Union on June 1, 1796. The capital is Nashville. In the order of population (1950) the principal cities are Memphis, Nashville, Chattanooga, and Knoxville (qq.v.). From e. to w. the extreme length of Tennessee is 432 m., and from w. to s. the extreme width is 115 m. Area of the State, 42,246 sq.m., including 285 sq.m. of inland water surface. The population of the State (1950) is 3,291,718.

The surface of the State is divided into a number of well-marked topographical provinces which tend to decrease in height from e. to w. The easternmost part of the State consists of the Appalachian belt of mountains, with a width of from 10 to 15 m. The belt is formed by the Great Smoky and Unaka mountains, the main ridges of which average 5000 ft. in elevation and in places exceed 6000 ft. The highest point in the State, Clingman's Dome, is in the portion of the range which is located in Sevier Co., and is 6642 ft. above sea level. Immediately to the w. of the mountain belt is the Great Valley of e. Tennessee, a depression 30 to 60 m. wide, consisting of an alternate succession of parallel ridges and valleys. It is bordered on the w. by the Cumberland Plateau, which possesses an average elevation of over 1800 ft. above sea level and an extreme elevation of 3550 ft. The eastern edge of the plateau is a straight, abrupt scarp, but its western edge has been deeply eroded by headwater streams. Next toward the w. is the Highland Rim Plateau, a plain which



C. S. Hammond & Co., N.Y.

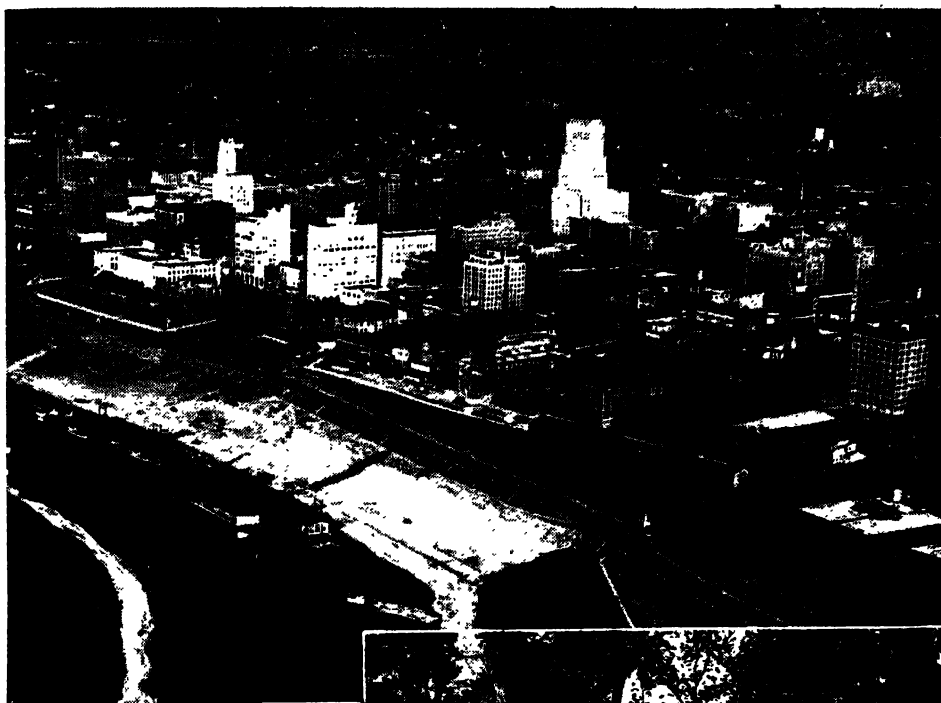
possesses an elevation of about 1000 ft. along its eastern border, and between 600 and 800 ft. along its western margin, and which lies, for the most part, a few miles w. of the Tennessee R. in its northern course across the State. Within the highland plain and 300 to 400 ft. below its level, in central Tennessee, is an oval depression about 125 m. long and 60 m. wide, known as the Central Basin. West of the Highland Plateau is the West Tennessee Plain, 600 to 800 ft. high on its eastern border, with a westward slope to 300 or 400 ft. Bordering the West Tennessee Plain is the alluvial plain of the Mississippi R. The latter is a narrow belt, largely swampy, with a depressed area containing Reelfoot Lake, in the northern portion of the State. The lowest point in the State is situated along the Mississippi R. in Shelby Co., and is 182 ft. above sea level. The average elevation is about 900 ft. above sea level.

The climate of Tennessee is generally mild and equable. The mean annual temperature is 58°F., and the variation from this is not over 2 or 3 degrees in any section, except that of the Appalachian region. July is usually the hottest month and January the coldest. The annual rainfall averages about 50 inches and is well distributed geographically. The average annual snowfall is about 8 inches. The prevailing winds are from the s. and the s.w.

The drainage of the entire State reaches the Mississippi R. The eastern portion is

drained by the Tennessee R., which flows s.w. into Alabama and then w.n.w. to the Mississippi. The Cumberland R. flows south-westward into the Tennessee Central Basin, turns and flows w. and then turns n. into Kentucky to the Mississippi. The West Tennessee Plain is drained directly into the Mississippi through the Wolf, Hatchie, Forked Deer, and Obion rivers. The Cumberland and the Tennessee, and a few of the larger tributaries of the latter in E. Tennessee are navigable.

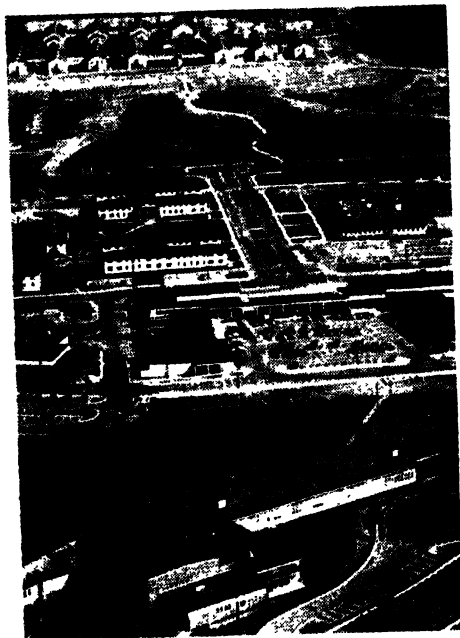
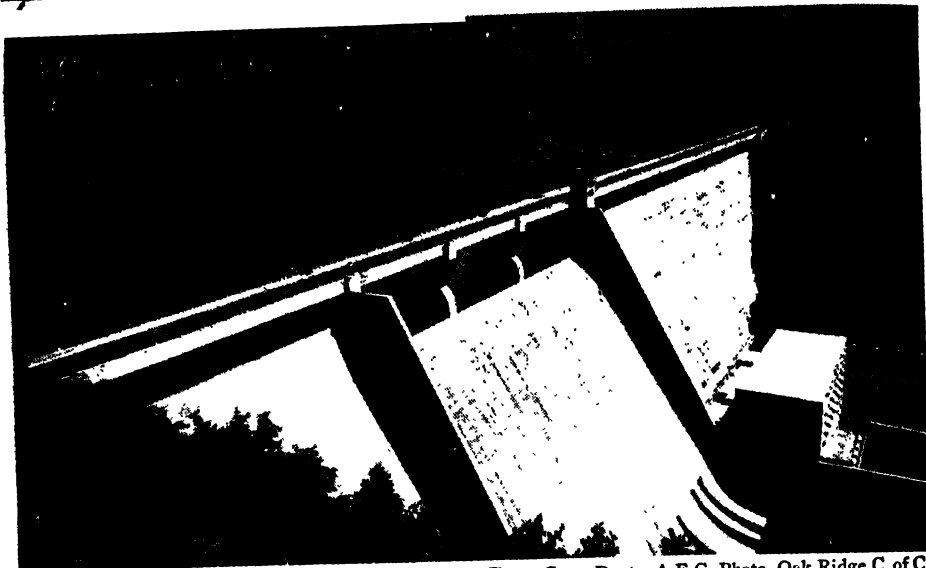
The Tennessee Valley Authority, an independent corporate agency of the Federal government created in 1933 to provide for the unified development of all the resources of the 40,910-sq. m. watershed of the Tennessee R. and its tributaries, has created approximately 600,000 acres of water in a series of lakes as a result of the construction of numerous dams in the State. One of the most important of the lakes, that created by the Norris Dam (see DAMS), possesses an area of over 80 sq. m. and a shore line of more than 800 m. In addition, the TVA has created three parks which are similar in facilities to the State parks. Tennessee possesses sixteen State parks covering an area of more than 68,000 acres, eleven State forests covering more than 120,000 acres, and fifteen fish hatcheries, lakes, and game preserves, which cover a total area of about 236,000 acres. In addition, the State contains a number of national monuments, military parks, and the Great Smoky Mountains



Tenn. Cons. Dept.; Chatt. C. of C.

IN TENNESSEE. Above: Aerial view of the city of Memphis, on the Mississippi River. At right: "The Hermitage," home of Andrew Jackson near Nashville. Below: Moccasin Bend, meander of the Tennessee River. Chattanooga is at right.





Tenn. Cons. Dept.; A.E.C. Photo, Oak Ridge C. of C.  
IN TENNESSEE. Above: Norris Dam, built by  
the Tennessee Valley Authority. Left: Aerial  
view of atomic-energy laboratories and other  
installations at Oak Ridge.

boar hunt. There are approximately 19,000 sq. m. of forests, of which the Federal government controls more than 1200 sq. m. The chief trees include yellow pine, yellow poplar, oak, chestnut, gum, and hemlock. The forests yield an average of 500,000,000 board ft. of lumber a year.

Mining is an important industry in the State and the principal mineral is coal. Approximately 5000 sq. m. of Tennessee is underlaid with coal and in a recent year more than 5,000,000 short tons of coal were mined. The State leads the nation in the production of iron pyrites and is the only source of sinter iron. Other minerals are zinc, copper, silver, gold, cement rock, marble, phosphate, and manganese ore. Recently the total annual value of mineral products in the State exceeded \$90,000,000.

Manufacturing is the most important industry in value of products. In a recent year about 3300 manufacturing establishments employed more than 221,000 wage earners; value added to products by manufacture totaled about \$957,500,000. The principal products are cotton cloth, knitted goods, rayon, silk, woolen, and worsted goods, celluloid, footwear, aluminum, and plastics. Meat packing, food processing, printing and publishing, and lumbering are also important.

National Park (q.v.), half of which is located in North Carolina and half in Tennessee. Game, such as foxes, rabbits, oposums, and ducks, is plentiful, and the streams contain bass and trout. The Cherokee National Forest is the home of numbers of Prussian boars, which were originally imported from Germany; in November of each year the forest is the scene of a wild-



Agriculture supports more people than any other industry. In a recent year more than 231,500 farms, embracing a total area of almost 18,600,000 acres, were valued at (land and buildings) approximately \$1,432,000,000. The chief crop is corn, of which about 60,360,000 bushels were produced in a recent year. Other crops are tobacco (143,214,000 pounds), cotton (534,000 bales), winter wheat, oats, hay, Irish potatoes, sweet potatoes, peanuts, barley, peas, tomatoes, apples, peaches, and strawberries. Livestock raising, dairying, and beekeeping are also important agricultural industries. In a recent year the State ranked seventh in the nation in the production of honey. Livestock in the State recently numbered 1,550,000 cattle (including 640,000 milch cows), 270,000 sheep, 197,000 mules, and 113,000 horses.

Transportation facilities in Tennessee include about 3500 m. of main-track railway, 7800 m. of State highways, and 61 airports, of which 26 are municipal and 20 are equipped for night flying.

Attendance at the elementary and secondary schools of Tennessee is free for all children more than six years old, and compulsory throughout the full school year for all children between the ages of seven and sixteen except for those who have completed high school. In a recent year more than 4700 public elementary and secondary



IN TENNESSEE. Right: A marble quarry. Below: Ferromanganese furnaces in operation.

Tenn. Cons. Dept.



schools were attended by more than 659,000 students and staffed by about 22,000 teachers. Separate schools are maintained for white and Negro students. Since the adoption of a uniform school code in 1925 Tennessee has prohibited the teaching of the theory of evolution (see BRYAN, WILLIAM JENNINGS; DARROW, CLARENCE) in all schools partially or wholly supported by the State. In addition, the State demands that white children be taught only by white persons who have been born in the U.S. and whose parents could speak English, and who themselves have spoken English since childhood. Institutions of higher learning which the State supports include the University of Tennessee at Knoxville, founded in 1794, the Agricultural and Industrial State Teachers College (1912) for Negroes at Nashville, the Tennessee Polytechnic Institute (1916) at Copkeville, the Alvin C. York Agricultural Institute at Jamestown, and a number of teachers colleges. Among the private institutions of higher learning in the State are Fisk University (1866), for Negroes, at Nashville, the University of the South (1857) at Seawanee, Vanderbilt University (1873) at Nashville, the University of Chattanooga (1867) at Chattanooga, Cumberland University (1842) at Lebanon, and the Meharry Medical College (1876), for Negroes, at Nashville.

Tennessee is governed according to the terms of the constitution of 1870. Executive authority is vested in a governor, who is elected for a two-year term, and who may not hold office for more than three consecutive terms. The governor is the only elected official in the executive department. There is no lieutenant governor in the event of a vacancy in the governor's chair, the speaker of the senate becomes the acting governor. A comptroller of the treasury and a secretary of state are chosen by a joint ballot of the senate and house of representatives for two-year terms, and an attorney general is appointed for an eight-year term by the justices of the supreme court. Legislative authority is vested in a general assembly which consists of a senate of 33 members and a house of representatives of 99 members, all elected for two-year terms. Judicial authority is vested in a supreme court of 5 justices elected for eight-year terms, a court of civil appeals, chancery courts, circuit courts, county courts, criminal courts, justices of the peace, and recorder's courts. Qualified voters are all U.S. citizens who have passed

the age of twenty-one, resided in the State a minimum of one year, the county a minimum of six months, and the voting district a minimum of thirty days, and, if under the age of fifty, have paid a poll tax. Chiefly because of the poll tax, the voting disfranchisement is great; in a recent Presidential election approximately 30% of the potential voters of the State cast ballots. Tennessee is divided into 95 counties and is represented in the Congress of the U.S. by 2 senators and 9 representatives.

*History.* The first European to explore the region was probably the Spanish explorer Hernando de Soto, in 1541. In 1584 the territory was a part of an English grant to Sir Walter Raleigh, and in 1665 Charles II granted the territory lying between lat. 29° and 36° 30' N. to the Lord Proprietors of Carolina (see NORTH CAROLINA: *History*; SOUTH CAROLINA: *History*). The French explorer La Salle built a fort near the present site of Memphis in 1682 and called it Fort Prud'homme. The first English settlement established in the territory was Fort Loudon, which was built in 1756 at the suggestion of the governor of Virginia. The fort was garrisoned by English Royal troops, but in 1766 the Cherokee Indians captured it and massacred the soldiers and the settlers in the surrounding region. The region, which was then regarded as a common hunting ground by the Cherokees, Chickasaws, Choctaws, Creeks, and Miamis (qq.v.), was opened to the colonists by explorers and hunters such as Daniel Boone (q.v.). In 1768 the Iroquois (q.v.) Indians, who claimed sovereignty of the territory by conquest, ceded their claim to the English. Settlements were established in Tennessee soon afterward and in 1771, after the defeat of the Regulators (q.v.) in North Carolina, a number of the Regulators traveled to the region, supposing the territory to be Virginia soil. When the territory was found to be within North Carolina, which did not, however, assert jurisdiction or protect settlers from Indian attacks, the inhabitants of two of the settlements in Tennessee met in 1772 and formed the Watauga Association (q.v.), which served as a form of government for several years. The Watauga settlers gave the name Washington District to their colony, and in 1776 it was annexed to North Carolina.

The number of settlers increased rapidly, and nearly 500 men under John Sevier and Isaac Shelby (qq.v.) crossed the mountains and took part in an attack on the British in

1780 during the American Revolution. In 1784 North Carolina ceded to the U.S. government the western lands which had originally been constituted as the Watauga Association. The cession was to be accepted within two years, North Carolina maintaining sovereignty over the lands in the interim. The inhabitants, indignant at being transferred without their consent, formed the State of Franklin or Frankland (see FRANKLIN, STATE OF), and elected John Sevier as their governor. Congress ignored the request of the State of Franklin to be recognized as a State of the Union, and North Carolina promptly repealed the act of cession and asserted its jurisdiction. In 1788 North Carolina legislated the State of Franklin out of existence and imprisoned Sevier, charging him with high treason; however, he escaped. In 1790, North Carolina again ceded the region, called the Territory South of the River Ohio, to the U.S. government, and a Territorial government was established. In 1796 the Territory was admitted to the Union as the State of Tennessee, with the addition of the region extending west from the original State of Franklin to the Mississippi. Sevier, pardoned, served as the first governor of the new State.

A strong Union party existed in Tennessee at the outbreak of the Civil War, and in February, 1861, the people refused to hold a convention to consider secession, but when President Abraham Lincoln issued his call for troops, sentiment changed and the State voted itself out of the Union in June. During the Civil War the State furnished the Confederacy with about 175,000 soldiers; more than 30,000 men from Tennessee served with the Union army. Andrew Johnson (q.v.) who later became the seventeenth President of the U.S., had refused to resign his seat in Congress as the senator from Tennessee, and when Union troops drove the Confederate governor from the State, Johnson was appointed military governor, a position he held until his election to the Vice-Presidency of the U.S. The State was readmitted to the Union after the close of the war, on July 23, 1866. The Reconstruction (q.v.) period proved difficult for the State, but Tennessee was not subject to government by carpetbaggers (q.v.). During the latter part of the 19th century, the exploitation of the State's natural resources, and the growth of the cotton industry aided economic recovery. In 1942, during World War II, the town of Oak Ridge (q.v.), Ten-

nessee, was established near Knoxville to provide a residence community for personnel working in the various Oak Ridge plants of the atomic-energy project (see ATOMIC ENERGY AND ATOMIC BOMB).

From 1877 through 1952, the voters of Tennessee have cast a majority of their ballots for the Democratic Presidential candidate in every election except those of 1920, 1928, and 1952, when the Republican candidates received a majority or plurality of the votes. In the 1952 Presidential election General Dwight D. Eisenhower, the Republican candidate, received 446,147 votes, the Democratic candidate Adlai Ewing Stevenson received 443,710 votes, and minor party candidates received an aggregate of 1696 votes.

**TENNESSEE RIVER**, the largest tributary of the Ohio River. It is formed by the confluence of the Holston and the French Broad rivers, about 4 miles E. of Knoxville. Including the Holston, its length is about 1200 m. Its drainage basin includes about 39,000 sq. m. The main stream is navigable for 673 m. from its mouth. The river takes its name from the old Cherokee Indian town, Tennessee, which stood near the present town of Lenoir, Tenn.

**TENNESSEE, UNIVERSITY OF**, a coeducational, State-controlled institution of higher learning, situated at Knoxville, Tenn. It was established in 1794 as Blount College; it became a State institution and adopted the present name in 1870. At Knoxville courses are offered in the liberal arts, engineering, home economics, education, law, agriculture, and business administration, leading to undergraduate and graduate degrees. Schools of medicine, dentistry, pharmacy, nursing, public health, and biological sciences are located at Memphis, Tenn. In 1947 the university opened a branch of its graduate school in Oak Ridge, Tenn., as a part of the Nuclear Studies Institute, which is attended chiefly by persons employed in the atomic-energy plants of Oak Ridge who are studying for graduate degrees. In a recent year the enrollment was over 12,000, and the faculty numbered about 1380; the library contained about 299,000 volumes.

**TENNESSEE VALLEY AUTHORITY**. See WATER POWER.

**TENNIEL**, SIR JOHN (1820-1914), English cartoonist and illustrator. From 1851 to 1901 he was cartoonist for *Punch*, executing about 2300 cartoons, including the famous political cartoon "Dropping the Pilot" in March, 1890,



Sur John Fennel

when the kaiser dismissed Bismarck and also innumerable small drawings and designs for Punch's *Almanac* and Punch *Pocket books*. He was knighted in 1893. Among his principal book illustrations are those for Esop's *Fables* (1848), Lewis Carroll's *Alice's Adventures in Wonderland* (1866) and *Through the Looking Glass* (1870), and *Legendary Ballads*.

**TENNIS**, a term principally applied to the game of lawn tennis but also applied to court (or oval) tennis a much different game (see COURT TENNIS). Tennis or lawn tennis, is played either outdoors or indoors but usually outdoors with rackets and balls by two or four people on a court of turf or of some hard, even substance such as clay, concrete, or wood. The game when played by two contestants is known as "singles", and by four, as "doubles".

The court for singles is 78 ft long and 27 ft wide. For doubles the court is the same length, but the width is extended by the addition on either side of an alley  $4\frac{1}{2}$  ft wide, making the entire width of the court for doubles 36 ft. A single court on which either game may be played is generally used, it is marked out with white lines to indicate the different dimensions for singles and doubles, and the various divisions of the court necessary for the game (see DIAGRAM).

For the doubles court, two lines known as side lines are marked longitudinally from one end of the court to the other 36 ft apart, for the singles court the side lines are 27 ft apart. At either end of the court a line known as the base line is marked across the entire width of the court, 36 ft, the base lines serve for both doubles and singles. Eighteen ft in longitudinally from each base line, a line known as the service line is marked from one singles-court side line to the other, a distance of 27 ft. The areas between the base lines and service lines are known as the back courts. Across the exact center of the court from one side to the other a net is stretched between posts  $3\frac{1}{2}$  ft high and staked into the ground 3 ft outside the court, the net must be exactly 3 ft high at the center. Lines known as center service lines are marked on the court longitudinally from the center of each service line to the center of the net. The area of each court from service line to net is thus divided into two equal parts, each known as a service court. Each service court is 21 ft long and  $10\frac{1}{2}$  ft wide. The ball used in tennis is made of inflated rubber coated with flannel, it is between  $2\frac{1}{8}$  and  $2\frac{5}{8}$  inches in diameter and weighs between 2 and  $2\frac{1}{4}$  ounces. The racket is usually made of wood and consists of an oval shaped head strung usually with gut or nylon and a handle, the racket weighs from 14 to 16 ounces.

The game is begun by a player serving the ball, i.e., striking it across the net to the opponent's side according to the rules described below, the player who begins the game is called the "server" and the one who receives the ball the "receiver". The side to serve first is determined by the toss of a coin or of a racket. The server delivers the ball from behind the base line and within the center mark and side line of his right hand service court into the diagonally opposite or right hand service court of his opponent. The server must maintain contact with the ground, after tossing the ball into the air or letting it fall, he must strike the ball before it touches the ground. He is permitted two tries in which to hit the ball into the diagonally opposite service court of his opponent. If a try results in the ball hitting the net, striking any part of the opponent's court except the diagonally opposite service court, or going out of the court altogether, it is called a "fault". If both tries result in faults, the opponent scores a point. Faults are also called if the



*Playing a game of tennis in 17th-century France*

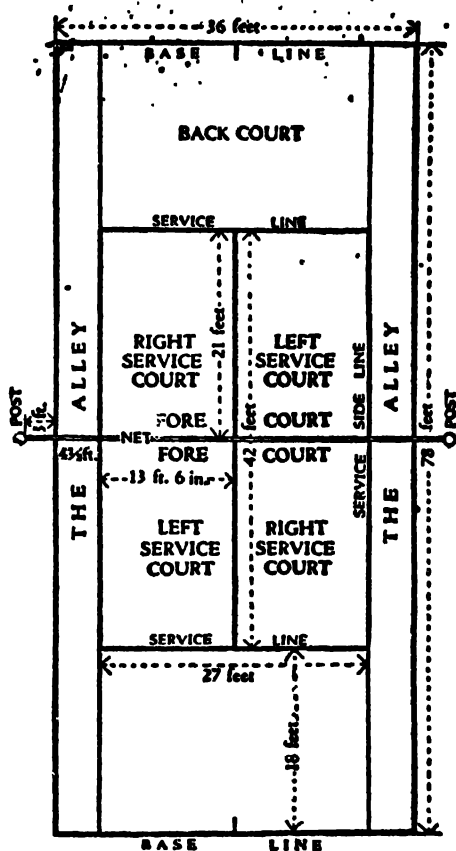
server breaks contact with the ground before service is completed or if he steps over the base line. If the ball, on either try, strikes the top of the net and falls into the diagonally opposite service court, it is called a "let" and the server is permitted to make the try over.

After the ball is successfully served, the receiver endeavors to return it over the net to any part of the server's court. If he succeeds in so doing, the server then endeavors to hit the ball back over the net into any part of the receiver's court. A player may strike the ball after service before it bounces or after it has bounced once. The ball is kept in play until either player or side has failed to hit the ball before it has bounced twice, or has driven it into the net, or has hit it out of the court. In each case the opponent scores a point. After the first point has been played, the server puts the ball into play from the base line of his left-hand service court into his opponent's diagonally opposite or left hand court; the server continues serving alternately from the base line of each service court until an entire game (see below) has been played, and then his opponent serves for a game. In doubles each of the two players serves a game in turn, one of the opponents serving between each turn.

The player or side winning the first point scores 15, the opponent at this juncture has a score of zero or "love." The second winning point counts 15 additional, making a

total of 30; the winning of the third point brings 10 more, making 40. The winning of the fourth point gives the player or side the game on condition that the opponent has not scored more than 2 points. If both sides have won three points, making the score "40 all," the score is said to be at "deuce," equivalent to 30 against 30, and the game thus is carried on until one of the sides wins by two points. When the score is deuce, the players or side scoring the next point is said to have the "advantage." The player or side first winning 6 games while the opponent has won 4 or fewer wins the "set." If when one player or side has won 6 games, the opponent has won 5, the game goes on until one of the sides has won 2 more games than the other. In championship matches for women the victor is the side which wins the first 2 sets out of a possible 3, and for men the first 3 out of a possible 5. Championship matches are judged by nineteen officials: one umpire, one referee, one net judge, two foot fault judges, and ten linesmen.

The modern game of lawn tennis was invented in England in 1873 by Major Walter C. Wingfield, a British army officer for use at lawn parties. Major Wingfield claimed that he modeled the game, which he called "spharistike," after an ancient Greek game, authorities believe, however, that in reality he adapted to outdoor play the principles of the widely popular English game of court tennis. The early participants



A. G. Spalding & Bros.

Diagram of a tennis court for doubles

in the game preferred to call it "tennis-on-the-lawn" or "lawn tennis". The game was introduced into Bermuda the same year, and from Bermuda was brought to the United States by an American girl, Miss Mary Ewing Outerbridge, of Staten Island, N.Y. The first game of lawn tennis played in this country took place on the grounds of the Staten Island Cricket and Baseball Club in the spring of 1874. By the last decade of the 19th century, lawn tennis had been introduced into British colonies all over the world and into many other parts of the world. Tennis, today is one of the most popular games in the world. The game can be played from childhood until well into middle age, and the number of its players is in the millions.

In the United States the rules and standards for the game fluctuated widely from locality to locality until 1881, when the

United States Lawn Tennis Association was organized to standardize rules and equipment; the Association is still the governing body for amateur tennis in this country. Play for the annual United States singles championships for men began in Newport, R.I., in 1881; the national men's singles championships continued to take place annually in that city until 1915, when they were transferred to Forest Hills, N.Y. Matches for the national women's singles began in 1887, at the Philadelphia Cricket Club, and continued there until 1921, when they were likewise brought to Forest Hills. In addition to the above-mentioned championships, annual tournaments are held in the United States to determine the national champions in men's doubles, women's doubles, intercollegiate singles and doubles, and other categories. Of international importance are the Davis Cup (q.v.) amateur matches held annually to determine the champion national tennis team of the world. Among other important championships are the annual Wightman matches played between teams of women from the United States and Great Britain; and the British amateur championships for men and women played annually at Wimbledon, England. Since the best amateur players in the world generally participate in the British tournament, the winners have a good claim to the world championships for the year in which they win the various titles.

Professional tennis has flourished in the United States since 1926, when the sports promoter Charles C. Pyle organized a professional tour of the United States for a group of leading players of the United States and France, including Suzanne Lenglen, Mary K. Browne, Vincent Richards, and Howard O. Kinsey. Since that time many groups of players have made profitable tours of the United States and other countries. Many of the best amateur players of the United States and other countries become professional players at the height of their amateur careers. The governing body for professional tennis in this country is the United States Professional Lawn Tennis Association, organized in 1927. The Association holds an annual tournament to determine the United States professional championships.

Following are tables of the winners in the important American amateur championships, the British amateur singles championship, and the United States professional singles championship.

## WINNERS OF UNITED STATES NATIONAL TENNIS CHAMPIONSHIP..

## MEN'S SINGLES

<i>Player</i>	<i>Year</i>	<i>Player</i>	<i>Year</i>
Richard D. Sears	1881-1887	William T. Tilden, 2nd	1929
Henry W. Slocum, Jr.	1888-1889	John H. Doeg	1930
Oliver S. Campbell	1890-1892	H. Ellsworth Vines, Jr.	1931-1932
Robert D. Wrenn	1893-1894	Fred J. Perry (Eng.)	1933-1934
Fred H. Hovey	1895	Wilmer Allison	1935
Robert D. Wrenn	1896-1897	Fred J. Perry (Eng.)	1936
Malcolm D. Whitman	1898-1900	J. Donald Budge	1937-1938
William A. Larned	1901-1902	Robert L. Riggs	1939
Hugh L. Doherty (Eng.)	1903	Donald McNeill	1940
Holcombe Ward	1904	Robert L. Riggs	1941
Beals C. Wright	1905	Frederick R. Schroeder, Jr.	1942
William J. Clothier	1906	Joseph R. Hunt	1943
William A. Larned	1907-1911	Frank A. Parker	1944-1945
Maurice E. McLoughlin	1912-1913	Jack A. Kramer	1946-1947
Richard N. Williams, 2nd	1914	Richard Gonzales	1948-1949
William Johnston	1915	Arthur Larsen	1950
Richard N. Williams, 2nd	1916	Frank Sedgman (Australia)	1951-1952
R. Lindley Murray	1917-1918	Anthony Trabert	1953
William Johnston	1919	E. Victor Seixas, Jr.	1954
William T. Tilden, 2nd	1920-1925	Anthony Trabert	1955
Jean R. Lacoste (Fr.)	1926-1927		
Henri Cochet (Fr.)	1927		

## WOMEN'S SINGLES

<i>Player</i>	<i>Year</i>	<i>Player</i>	<i>Year</i>
Ellen F. Hansell	1887	Mrs. Franklin I. Mallory	1920-1921
Bertha L. Townsend	1888-1889	(Bjurstedt)	
Ellen C. Roosevelt	1890	Helen N. Wills	1923-1925
Mabel E. Cahill	1891-1892	Mrs. Franklin I. Mallory	1926
Aime M. Terry	1893	Helen N. Wills	1927-1929
Helen R. Helwig	1894	Betty Nuthall	1930
Juliette P. Atkinson	1895	Mrs. Helen Wills Moody	1931
Elisabeth H. Moore	1896	Helen Jacobs	1932-1935
Juliette P. Atkinson	1897-1898	Alice Marble	1936
Marion Jones	1899	Anita Lizana (Chile)	1937
Myrtle McAteer	1900	Alice Marble	1938-1940
Elisabeth H. Moore	1901	Mrs. Sarah P. Cooke	1941
Marion Jones	1902	Pauline M. Betz	1942-1944
Elisabeth H. Moore	1903	Mrs. Sarah P. Cooke	1945
May G. Sutton	1904	Pauline M. Betz	1946
Elisabeth H. Moore	1905	A. Louise Brough	1947
Helen H. Homans	1906	Mrs. Margaret O. du Pont	1948-1950
Evelyn Sears	1907	Maureen Connolly	1951-1953
Mrs. Maud Barger-Wallach	1908	Doris Hart	1954-1955
Hazel V. Hotchkiss	1909-1911		
Mary K. Browne	1912-1914		
Molla Bjurstedt	1915-1918		
Mrs. George W. Wightman	1919		
(Hotchkiss)			

## MEN'S DOUBLES

Players	Year
Richard D. Sears and James Dwight	1886-1887
Oliver S. Campbell and V. G. Hall	1888
Henry W. Slocum, Jr. and H.A. Taylor	1889
V.G. Hall and Clarence Hobart	1890
Oliver S. Campbell and R.P. Huntington, Jr.	1891-1892
Clarence Hobart and Fred H. Hovey	1893-1894
M.G. Chace and Robert D. Wrenn	1895
C.B. Neel and S.R. Neel	1896
L.E. Ware and G.P. Sheldon, Jr.	1897-1898
Holcombe Ward and Dwight F. Davis	1899-1901
Reginald F. Doherty and Hugh L. Doherty	1902-1903
Holcombe Ward and Beals C. Wright	1904-1906
Fred B. Alexander and H.H. Hackett	1907-1910
Ray D. Little and Gus F. Touchard	1911
Maurice E. McLoughlin and Thomas C. Bundy	1912-1914
William Johnston and Clarence J. Griffin	1915-1916
Fred B. Alexander and H.A. Throckmorton	1917
William T. Tilden, 2nd, and Vincent Richards	1918
Norman E. Brookes and Gerald L. Patterson (Australia)	1919
William Johnston and Clarence J. Griffin	1920
William T. Tilden, 2nd, and Vincent Richards	1921-1922
William T. Tilden, 2nd, and B.I.C. Norton	1923
Howard O. Kinsey and Robert G. Kinsey	1924
Richard N. Williams, 2nd, and Vincent Richards	1925-1926
William T. Tilden, 2nd, and Francis T. Hunter	1927
George M. Lott, Jr., and John F. Hennessey	1928
George M. Lott, Jr., and John H. Doeg	1929-1930
Wilmer L. Allison and John Van Ryn	1931
H. Ellsworth Vines, Jr., and Keith Gledhill	1932
George M. Lott, Jr., and Lester R. Stoefen	1933-1934
Wilmer L. Allison and John Van Ryn	1935
J. Donald Budge and C. Gene Mako	1936
Gottfried von Cramm and Henner Henkel (Ger.)	1937
J. Donald Budge and C. Gene Mako	1938
Adrian K. Quist and John Bromwich (Australia)	1939
John A. Kramer and Frederick R. Schroeder, Jr.	1940-1941
Gardnar Mulloy and William F. Talbert	1942
Jack A. Kramer and Frank A. Parker	1943
Robert Falkenburg and W.D. McNeill	1944
Gardnar Mulloy and William F. Talbert	1945-1946
Jack A. Kramer and Frederick R. Schroeder, Jr.	1947
Gardnar Mulloy and William F. Talbert	1948
John Bromwich and William Sidwell (Australia)	1949
John Bromwich and Frank Sedgman (Australia)	1950
Frank Sedgman and Ken McGregor (Australia)	1951
Mervyn Rose and E. Victor Seixas, Jr.	1952
Mervyn Rose and Rex Hartwig (Australia)	1953
Anthony Trabert and E. Victor Seixas, Jr.	1954
Kosei Kamo and Atsushi Miyagi (Japan)	1955



## WOMEN'S DOUBLES

Players	Year
Ellen C. Roosevelt and Grace W. Roosevelt	1890
Mabel E. Cahill and Mrs. W.F. Morgan	1891
Mabel E. Cahill and A.M. McKinley	1892
Aline M. Terry and Hattie Butler	1893
Helen R. Helwig and Juliette P. Atkinson	1894-1895
Elisabeth H. Moore and Juliette P. Atkinson	1896
Juliette P. Atkinson and Kathleen Atkinson	1897-1898
Myrtle McAteer and Jane W. Craven	1899
Edith Parker and Hallie Champlin	1900
Juliette P. Atkinson and Myrtle McAteer	1901
Juliette P. Atkinson and Marion Jones	1902
Elisabeth H. Moore and Carrie B. Neely	1903
May G. Sutton and Miriam Hall	1904
Helen Homans and Carrie B. Neely	1905
Mrs. L.S. Coe and Mrs. D.S. Platt	1906
Carrie B. Neely and Marie Weimer	1907
Evelyn Sears and Margaret Curtis	1908
Hazel V. Hotchkiss and Edith E. Rotch	1909-1910
Hazel V. Hotchkiss and Eleanora Sears	1911
Mary K. Browne and Dorothy Green	1912
Mary K. Browne and Mrs. R.H. Williams	1913-1914
Mrs. George W. Wightman (Hotchkiss) and Eleanora Sears	1915
Molla Bjurstedt and Eleanora Sears	1916-1917
Eleanor Goss and Marion Zinderstein	1918-1920
Mary K. Browne and Mrs. R.H. Williams	1921
Helen N. Wills and Mrs. J.B. Jessup	1922
Kathleen McKane and Mrs. B.C. Covell	1923
Helen N. Wills and Mrs. George W. Wightman	1924
Helen N. Wills and Mary K. Browne	1925
Elizabeth Ryan and Eleanor Goss	1926
Mrs. L.A. Godfree and Ermytrude Harvey	1927
Helen N. Wills and Mrs. George W. Wightman	1928
Mrs. Phoebe Watson and Mrs. L.R.C. Michell	1929
Betty Nuthall and Sarah Palfrey	1930
Mrs. E.B. Whittingstall and Betty Nuthall (Eng.)	1931
Helen Jacobs and Sarah Palfrey	1932
Betty Nuthall and Freda James (Eng.)	1933
Helen Jacobs and Sarah Palfrey	1934
Helen Jacobs and Mrs. Sarah Palfrey Fabyan	1935
Carolin Babcock and Mrs. M.G. Van Ryn	1936
Alice Marble and Mrs. Sarah P. Fabyan	1937-1940
Mrs. Sarah P. Cooke and Margaret Osborne	1941
A. Louise Brough and Margaret Osborne	1942-1947
A. Louise Brough and Margaret Osborne du Pont	1948-1950
Doris Hart and Shirley Fry	1951-1954
A. Louise Brough and Margaret Osborne du Pont	1955

## BRITISH AMATEUR (WIMBLEDON) SINGLES CHAMPIONS

<i>Players</i>	<i>Year</i>	<i>Players</i>	<i>Year</i>
William T. Tilden, 2nd (US)	1920-1921	J. Donald Budge (US)	1937-1938
Gerald L. Patterson (Australia)	1922	Robert L. Riggs (US)	1939
William M. Johnston (US)	1923	No Matches	1940-1945
Jean Borotra (France)	1924	Yvon Petra (France)	1946
Rene Lacoste (France)	1925	Jack A. Kramer (US)	1947
Jean Borotra (France)	1926	Robert Falkenburg (US)	1948
Henri Cochet (France)	1927	Frederick R. Shroeder, Jr (US)	1949
Rene Lacoste (France)	1928	Budge Patty (US)	1950
Henri Cochet (France)	1929	Dick Savitt (US)	1951
William T. Tilden, 2nd (US)	1930	Frank Sedgman (Australia)	1952
Sidney B. Wood, Jr (US)	1931	E. Victor Seixas, Jr	1953
H. Ellsworth Vines (US)	1932	L. Victor Seixas, Jr (US)	1953
John H. Crawford (Australia)	1933	Jaroslav Drobný (Egypt)	1954
Frederick J. Peiry (England)	1934-1936	Anthony Trabert (US)	1955

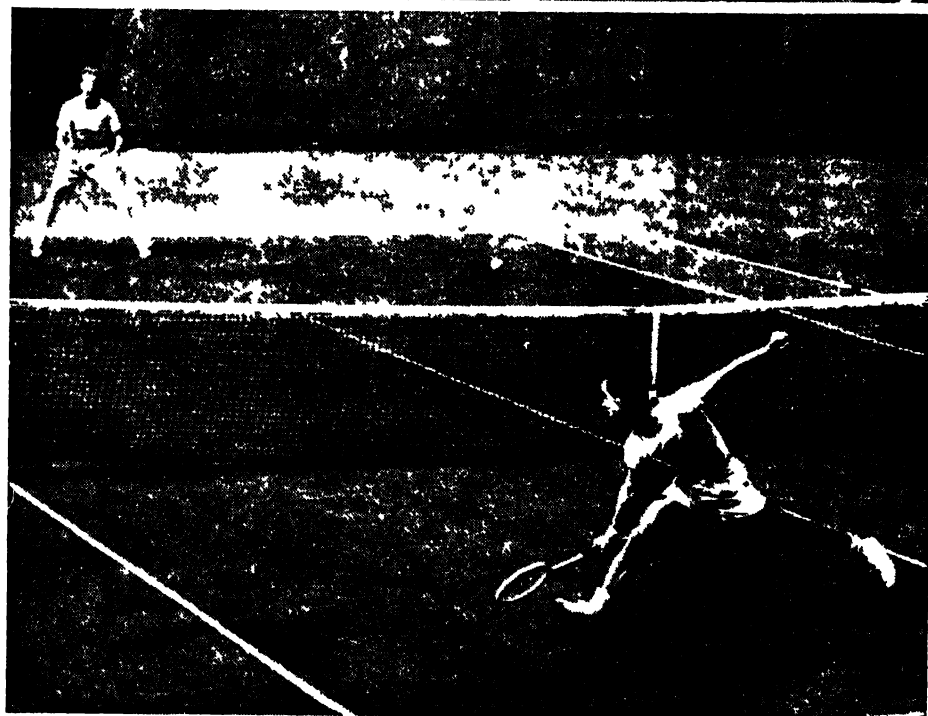
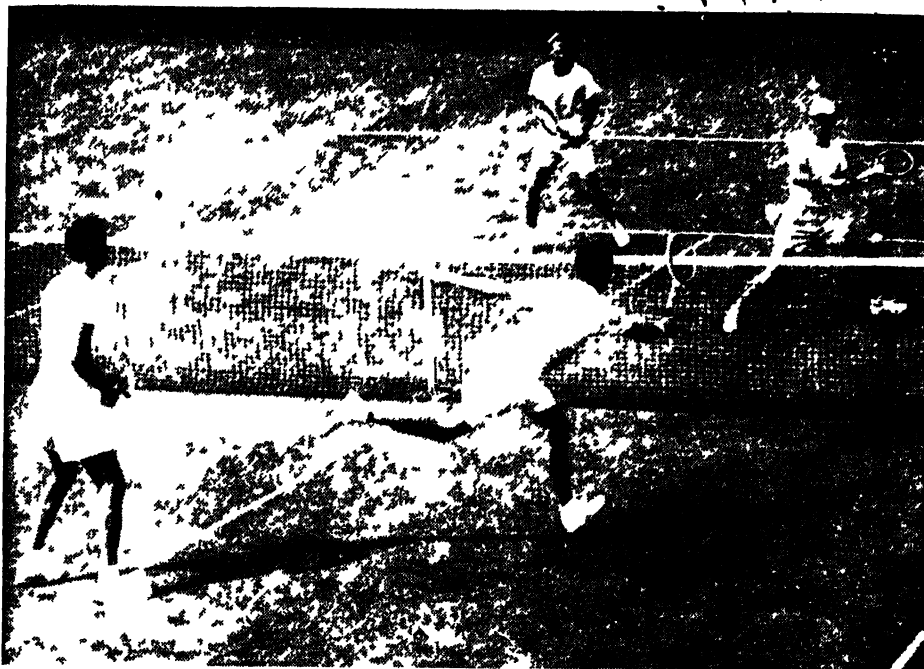
## UNITED STATES PROFESSIONAL SINGLES CHAMPIONS

<i>Players</i>	<i>Year</i>	<i>Players</i>	<i>Year</i>
Vincent Richards	1927-1928	Bruce Barnes	1943
Karel Kozeluh	1929	No Title Play	1944
Vincent Richards	1930 and 1933	Welby Van Hout	1945
William T. Tilden, 2nd	1931 and 1935	Robert L. Riggs	1946, 1947, and 1949
Karel Kozeluh	1932 and 1937	Jack A. Kramer	1948
Hans Nusslein	1934	Pancho Segura	1950, 1951, and 1952
Joseph Whalen	1936	Frank Kovacs	1953
Frederick J. Peiry	1938 and 1941	Richard Gonzales	1954 and 1955
Ellsworth Vines	1939		
J. Donald Budge	1940 and 1942		



Acme Photo

A Davis Cup tennis match in Brussels, Belgium



Wide World Photos

**TENNIS** *Top: United States team (foreground) against Australian team in Davis Cup match  
Bottom: Wayne Sabin (foreground) and Don Budge in a National Championship match*



Alfred, Lord Tennyson

**TENNYSON, ALFRED**, 1st BARON TENNYSON (1809–92), English poet born in Somersby, Lincolnshire, and educated at Trinity College, Cambridge University. In 1829, while at Cambridge, Tennyson wrote the spirited blank verse poem *Timbuctoo*, for which he received the chancellor's gold medal, and in the following year appeared his first published book *Poems, Chiefly Lyrical*. In 1831 he left Cambridge without taking a degree, and with his close friend Arthur Henry Hallam, son of the eminent British historian Henry Hallam, joined a Spanish revolutionary army in the insurrection against the despotic rule of King Ferdinand VII of Spain. The young men saw active service for a time in the Pyrenees, but participated in no military engagements. Tennyson's second volume, *Poems* (1832), contained such familiar verses as "The Lady of Shalott", "The Miller's Daughter", "The Palace of Art", "The Lotos Eaters", and "A Dream of Fair Women". The sudden death of his friend Hallam in September of the following year produced in Tennyson a profound spiritual depression, and he vowed to refrain from issuing any more of his verse for a period of ten years. During this time he devoted himself to reading and meditation, and wrote *The Two Voices* (1834), a philosophical poem on death and immortality.

In 1842, at the expiration of his self-imposed period of silence, Tennyson won wide acclaim with the publication of his *Poems*, in two volumes, which contained such works as "Morte d'Arthur", "Ulysses", "Locksley Hall", "Godiva", and the poignant lyric "Break, Break, Break". This work firmly established Tennyson's position as the foremost poet of his day, and served to bring him in contact with such distinguished literary figures as the essayist Thomas Carlyle, the novelist Charles Dickens, and the poets Samuel Rogers and Elizabeth Barrett Browning. In consequence of an improvident investment, Tennyson lost his modest fortune, and would have been reduced to extreme poverty had not the elder Hallam prevailed upon the British prime minister Sir Robert Peel in 1845 to grant the poet an annual government pension of 200 pounds for life. *The Princess*, a romantic treatment in musical blank verse of the question of women's rights, was published in 1847. The third edition of the poem (1850) contains a number of exquisite short lyrics.

Perhaps the most important year in Tennyson's literary and personal life was 1850. In June appeared his *In Memoriam*, a tribute to the memory of Arthur Hallam. Both the loose organization and intensely personal character of this poem perplexed many of the readers of Tennyson's day, but the work has since taken its place with John Milton's *Lycidas*, Percy Bysshe Shelley's *Adonais*, and Matthew Arnold's *Thyris* as one of the great elegies in English literature. In the same month Tennyson married Emily Sarah Sellwood, and in November was appointed poet laureate, succeeding William Wordsworth. He settled with his bride at Twickenham, in Middlesex, whence he moved three years later to his estate, Farringford, near Freshwater, in the Isle of Wight. There he resided for at least a part of each year for the remainder of his life.

In 1854 appeared "Charge of the Light Brigade", celebrating a memorable action by British cavalry in the Crimean War, and in the following year was published *Maud, and Other Poems*. With the first series of *Idylls of the King* (1859), Tennyson returned to the subject of the Arthurian cycle (qv), which he had already essayed in his "Morte d'Arthur". The book was enthusiastically received, more than ten thousand copies being sold in the first month of publication. *Enoch Arden* (1864), however, was the most immediately popular of all his volumes of poetry;

in the first year after publication sixty thousand copies were sold, and the title poem was translated into eight languages. Tennyson next produced the historical dramas *Queen Mary* (1875), *Harold* (1876), and *Becket* (1884). In 1884 he was created a peer, taking his seat in the House of Lords as Baron Tennyson of Freshwater and Aldworth. His other notable works include *Ballads and Other Poems* (1880), *Tiresias and Other Poems* (1885), *The Idylls of the King* (complete edition, 1885), *Demeter and Other Poems* (1889), and *The Death of Ænone and Other Poems* (published posthumously, 1892).

No English poet has produced acknowledged masterpieces in so many different literary genres as Tennyson. The consummate artistic excellence of his verse, resembling in many of its qualities the stately and heroic measures of the ancient Roman poet Vergil, has secured for him an enduring place in literature. He furnished perhaps the most notable example in English letters of the eclectic style, made up of elements derived from the styles of many of his distinguished predecessors; and he expressed a consoling, readily comprehensible philosophy.

**TENNYSON**, HALLAM, 2nd BARON TENNYSON (1852–1928), English author, second son of Alfred, Lord Tennyson, born in Twickenham. He became private secretary for his father, also doing literary work. The best known of his books is *Jack and the Beanstalk*, and he also contributed to magazines, publishing a translation of *Brunanburh* in the *Contemporary Review*, November, 1876, which his father afterward put into verse. Lord Tennyson served as governor and commander in chief of South Australia, 1899–1902, first acting governor-general of the Commonwealth of Australia in 1902, and governor-general of Australia, 1902–04. He was created a Knight Commander of St. Michael and St. George in 1899, and was awarded the Grand Cross of the Japanese Order of the Rising Sun, 1905. From 1913 until his death he was deputy governor of the Isle of Wight.

**TENOCHTITLAN**, the ancient capital of the Aztecs, occupying the site of present-day Mexico City.

**TENOR** (From Lat. *tenere*, "to hold"), in music, the highest adult male voice (with the exception of the falsetto), having an approximate range from C to C<sup>2</sup>. Two classes of tenors are recognized, namely, the *dramatic tenor* (*tenore robusto*) and the higher *lyric tenor* (*tenore de grazia*). In its lower

register, the quality of the dramatic tenor resembles that of the baritone (q.v.). The term "tenor" is derived from the fact that in the polyphonic (see POLYPHONY) music of medieval times the tenor voice "held" the melodic line, known as the *cantus firmus* or plain song (qq.v.), to which the altos (see CONTRALTO) above, and the baritones and basses (see BASS) below, furnished a harmony. "Tenor" is also used to designate the register of various musical instruments, such as the banjo, bassoon, horn, and viola. See also HARMONY; SINGING; VOICE.

**TENOS**, or TINOS, an island in the Ægean Sea, belonging to the Cyclades and known as one of the most productive in the group. On the south coast is the little town of the same name, called also Hagios Nikolaos (St Nicholas). It is on the site of the ancient town of Tenos, the remains of whose temple of Poseidon were laid bare in 1902. Area, 79 sq.m.; pop., about 12,000.

**TENREC**, or TANREC, common name applied to any of the burrowing insectivores constituting the family Tenrecidae, found only on the island of Madagascar. Tenrecs are the largest of the insectivores, attaining a length, including tail, of about 16 inches. They have robust bodies, short legs, and sharp, pointed snouts, and are often coated with spines, bristles, or hairs; some species are commonly called "hedgehogs" in Madagascar. The animals forage at night for earthworms, which constitute their chief article of diet, and live in burrows in the ground; they hibernate during the winter. Tenrecs are extremely prolific, producing as many as twenty-one young in a litter. Their flesh is edible. The common tenrec, *Tenrec caudatus*, differs from other species in lacking a tail.

**TENSE**, in grammar, the change in the form of a verb which marks the time of the action. See VERB.

**TENSILE STRENGTH**, or TENACITY, in physics, the degree of resistance to rupture possessed by all kinds of solid matter. In



The common tenrec

technical terms; the tensile strength of a substance is the greatest longitudinal stress which the substance can withstand without being torn asunder, such as the force required to break a wire by pulling at both ends. The tensile property may be compared with other material properties of resistance to applied force, such as resistance to crushing, shearing, or torsion. The absolute force required to pull apart a particular material depends both on the thickness or cross-sectional area at right angles to the stress, and the inherent tenacity of the material in question. Hence tenacity is usually expressed numerically with reference to a unit area of cross section: for example, number of pounds or tons per square inch, or kilograms per square centimeter necessary to produce rupture. The accompanying table gives the tensile strength of some of the more important materials used in commerce and industry.

#### TENSILE STRENGTH OF MATERIAL

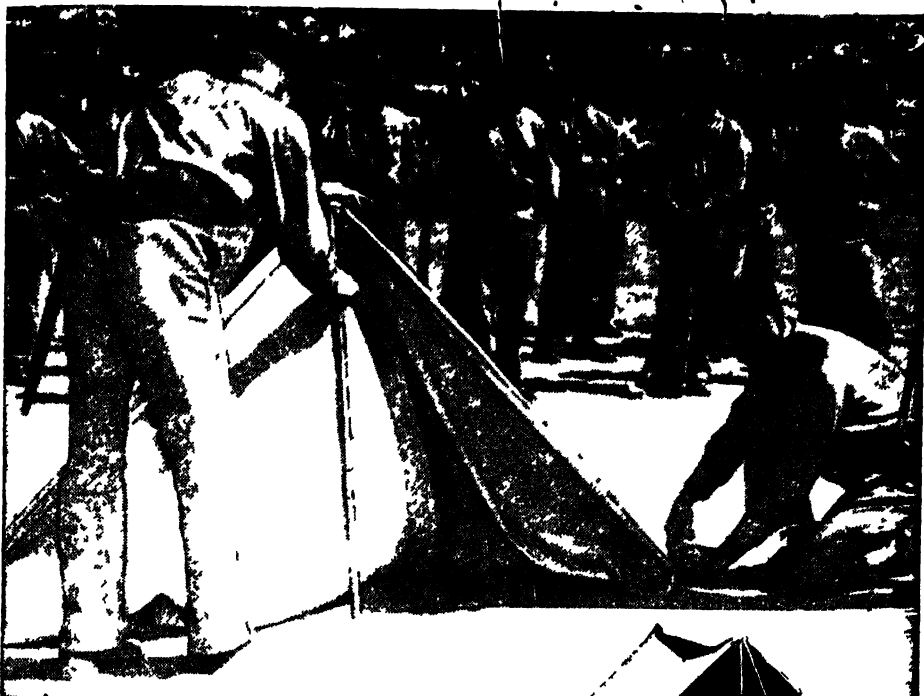
MATERIALS	LBS. PER SQ. IN.
<i>Metals</i>	
Aluminum	15,000
Aluminum bars (extruded)	28,000
Nickel aluminum	40,000
Aluminum wire	50,000
Brass (cast)	24,000
Bronze gun metal	35,000
Phosphor bronze	46,000
Manganese bronze	60,000
Aluminum bronze	70,000
Gold (cast)	20,000
Lead	2,000
Platinum wire	32,000
Silver (cast)	40,000
Tin	3,500
Zinc	5,400
Copper (cast)	24,000
Soft copper wire	35,000
Hard copper wire	60,000
Cast iron	20,000
Wrought iron	50,000
Carbon steel	60,000
Vanadium steel	70,000
Nickel steel	80,000
Manganese steel (cast)	90,000
Chrome-vanadium steel	100,000
Chrome-nickel-vanadium steel	129,100
Manganese steel (quenched)	140,000
Steel piano wire (.033 in. diameter)	370,000
<i>Woods</i>	
Ash	14,000

Black walnut	12,000
Beech	14,500
Cedar	10,000
Chestnut	10,000
Elm	13,400
Hemlock	8,700
Hickory	15,000
Locust	22,000
Maple	10,500
White oak	14,500
Poplar	7,000
Redwood	8,500
Spruce	14,500
White pine	12,000
Yellow pine	11,000
Red fir	10,000
Yellow fir	12,000
Teak	14,000

**TENSING NORKAY** (1914- ), Nepalese Sherpa mountain climber, born in Tama, Sola Khumbo. He tended livestock in his youth, acquiring considerable experience in mountain climbing. Ambitious to become a professional mountaineer, he emigrated (1933) to India, settling in Darjeeling. There, in 1935, he obtained employment as a porter with an expedition to Mt. Everest (see EVEREST, MOUNT), the highest known mountain in the world. He subsequently participated in numerous attempts to reach the summit of that peak. In October, 1952, he was selected as a chief climber and the head porter of a British expedition then being assembled for an attempt to scale Mt. Everest. Together with the New Zealand mountaineer Edmond P. Hillary, Tensing reached the summit on May 29, 1953. He was later decorated by the British and Nepalese governments for his achievement.

**TENSKWATAWA** (about 1775-1834), Indian prophet of the Shawnee tribe, brother of Tecumseh. He declared in 1805 that the god of the Indians had communicated his will to him that the tribes return to their ancient customs of life. He had a large following until the battle of Tippecanoe (1811), after which he was regarded as an impostor. See TECUMSEH; TIPPECANOE, BATTLE OF.

**TENT**, a portable structure of canvas, skin, or other fabrics, designed for shelter. Animal skins and foliage doubtless formed the earliest coverings, for which textile fabrics have been substituted. In the Book of Genesis the patriarchs are represented as dwelling in tents, probably the same as the modern Arab tents. The early Greek and Macedonian military tents were small coverings of skin, each



Official U.S. Marine Corps Photos

*Above* U.S. Marines demonstrating the proper method of putting up a shelter tent.  
*Right* The completed tent.



tent sheltering two soldiers. The Romans used two sorts of tents: one of canvas, constructed with two upright poles and a ridge pole between, similar to the camping tent of today, the other resembling a light hut—a wooden skeleton covered by bark, hides, thatch, or other material affording warmth or protection.

Modern military tents are made of cotton canvas, and in recent years since the adoption of the khaki and olive drab color and its wide use in military uniforms, tents made in this color have been very largely employed both in England and in America. In the United States Army five kinds of tents are employed: hospital, wall, a pyramidal, and shelter. Where possible a fly or outer roof is used over the tent proper. The shelter or "dog tent" is a small, easily carried contrivance which affords a degree of shelter for two men.

**TENTACULITES**, a genus of fossil shells found in Silurian and Devonian rocks and often so abundant that they constitute the greater portion of thin limestone beds. The

shells are of elongated conic form, with the outer surface marked by regular transverse striations and also by very delicate longitudinal lines in the hollow between the striations. The species range from  $\frac{1}{4}$  in. to 3 in. in length. They are generally considered to be the shells of fossil Annelids or Pteropods.

**TENT CATERPILLAR**, the larvae of four species of silk spinning moths of the genus *Malacosoma* (formerly *Chlorocampa*). The female of the apple tree tent caterpillar, *Malacosoma americana* a dull reddish brown moth, lays eggs in umblelike masses fastened to small twigs of apple, cherry, or thorn. The caterpillars hatch in early spring in the nearest fork of the twigs and spin a web or tent in which they live in company, but which they leave when hungry, to feed upon leaves. The eggs are easily seen in the winter and may be destroyed and the caterpillars killed just at nightfall within the tents by

burning or spraying with kerosene. An incredible amount of damage is done by these larvae every year to forest and fruit trees in America.

**TENTERDEN, CHARLES ABBOTT, 1st BARON** (1762-1832), English lawyer and jurist, born in Canterbury. He joined the Oxford circuit, and rapidly acquired a lucrative practice. He published, in 1802, his treatise on *Merchant Ships and Seamen*, in all respects the best-written book which had till then appeared on one department of English law and still a standard authority. In 1818 he was knighted, and chosen to succeed Lord Ellenborough as chief justice of the King's Bench. He was raised to the peerage in 1827 as Baron Tenterden of Hendon.

**TEN THOUSAND, RETREAT OF THE.** See ANABASIS; XENOPHON.

**TENTYRA.** See DENDERA.

**TENURE**, in the law of real property of feudal England, the manner in which a person held or owned real property. Under the feudal system the king owned all the land, and his vassals, as tenants, were entitled to hold only those portions of the land allotted by him and only under conditions imposed by him. The vassals or tenants in turn divided their lands among others, who became their vassals; this process was known as subinfeudation. Various forms of tenure were developed for the specific services required of the person holding the land. Feudal tenures were classified as *free*, by which the tenants held land as freeholders (see FREEHOLD); or as *base* or *nonfree*, by which the tenants held land as villeins. The earliest form of the free tenure was that by knight's service, involving allegiance and military service to the overlord and through him to the king. Later, in lieu of rendering military service, freehold tenants were permitted to make money payments known as *scutage* to the overlord. Such payments were levied at irregular intervals. Scutage payments were abolished by statute in the reign of Charles II, and were succeeded by payments annually of a fixed sum, or a certain amount of produce, as rent. Tenants making such payments were then said to hold their land *by free* and common socage tenure; such tenants took the oath of loyalty to the overlord but were relieved of any military obligations. An infant heir to lands held in socage tenure had to account when he became of age for the rents of the lands; the oldest male relative was termed the guardian in socage of the infant. Tenants

holding lands by socage tenure in towns were called burgage tenants.

During the Norman era there had existed in England a class of tenants, known as villeins, who were virtually serfs, and were required to perform menial services for the lord of the manor in return for their holdings. The villein was considered as attached to the manor, could be punished at will by the lord and could not leave the manor (see MANORIAL SYSTEM). Such tenure was known as the tenure of villeinage. Subsequently the payment of rent in some form was substituted for menial services, and the rights of the tenant in the land were evidenced by record made on the rolls of the court of the manor. Such tenants were then called copyhold tenants or copyholders. Copyhold tenure eventually took on the characteristics of freehold estates. The feudal control, by the overlord, of transfers of property by tenant was ended in 1290 by the Statute of Quia Emptores. See FEE; FEUDALISM.

**TENURE OF OFFICE ACT**, in law in the United States, a Federal statute enacted March 2, 1867, requiring Senate approval for the dismissal of Federal officers appointed by and with the advice and consent of the Senate. The disregard of this statute by President Andrew Johnson in removing Edwin Stanton from office as secretary of war resulted in the instituting of impeachment proceedings against the President by the House of Representatives. The act was repealed in 1887.

**TEN YEARS' WAR**, a Cuban insurrection fought between 1868 and 1878 against Spain. The insurrection, caused chiefly by the failure of the Spanish to grant various promised reforms to Cuba, broke out in Oct., 1868, when Carlos Manuel de Céspedes, a wealthy planter and political leader who favored the independence of Cuba, the gradual emancipation of slaves, and universal suffrage, proclaimed a revolution against Spain. All of the Cuban insurrectionists were not in favor of independence, some desiring annexation by the United States and others asking for governmental and social reforms but preferring to remain in the Spanish empire. A republican government was organized on April 20, 1869. The insurrection was characterized by guerrilla warfare, which became increasingly brutal as it progressed. Skirmishes were almost entirely limited to Cuba. Anticipated intervention by the U.S. never became a reality, and in 1878 the Cuban rebels were brought to submission by the Spanish and



the insurrection was ended by the signing on Oct. 10, in that year, of the Convention of El Zanjón, which stipulated that slavery would be abolished in Cuba and that governmental reforms would be instituted. However, the liberal spirit of the Convention was not fulfilled. See CUBA: *History*; SPAIN: *History*.

**TEOCALLI** (Nahuatl, "house of the god"), the ancient Mexican term for a temple and place of sacrifice and worship. The teocallis were commonly low, truncated, four-sided pyramids of earth, stone, or adobe brick, with a small temple on the flat summit. There was also as a rule a sacrificial stone on the summit, where public sacrifices were made. The term has come to be applied more specifically to the teocalli of Mexico City. This famous structure, completed in 1487, was a double pyramid with one temple to the Aztec god of war, Huitzilopochtli, and the other to the god of rain, called Tlaloc. *The Codex Telleriano-Remensis*, an Aztec document, records that 20,000 captives were sacrificed at the dedication ceremonies of the great teocalli.

**TEOS**, an ancient Ionian city on the w. coast of Asia Minor, n.w. of Ephesus. Here was a celebrated temple of Dionysus and a theater. Teos was prosperous till the Persian conquest. It was the birthplace of the lyric poet Anacreon. The place regained some importance in Roman times.

**TEOSINTE**, Mexican name for *Euchlaena mexicana*, a tall, spreading, leafy annual grass, closely related to maize or Indian corn. It is a native of the warmer parts of Mexico and Central America. The plant requires a rich, moist soil and a long, hot season. In its native habitat it grows rapidly, often attaining a height of 10 to 15 feet in a few months. The stalks bear tassels of staminate flowers and a number of small, flattened, poorly filled ears, the grain of which seldom matures farther north than lat 30°. On account of its extensive tillering (30 to 50 stalks often springing from a single root) and its very leafy habit, teosinte produces as much green fodder upon a given area of land as any other grass. The stalks are tender, and the whole plant is readily eaten by livestock. The plants may be cut several times during the season, but a single cutting just before the autumn frosts is said to yield about as much forage as the more frequent cuttings. Teosinte grows best in the United States in the region of the Gulf coast. In Texas, where it is grown for green forage and hay, it pro-

duces three crops a year, but matures seed only in the extreme southern part of the State.

**TEPEHUÁN**, a brave and warlike tribe of Piman stock. They are now restricted to the mountainous region in the extreme northwestern portion of Durango, with adjoining portions of Chihuahua and Sinaloa, Mexico. They are an industrious, agricultural people, living in houses of logs or stone set in clay mortar, or frequently utilizing the mountain caves for shelter. They cultivate cotton, which they weave into fabrics of beautiful texture and colors. They are now reduced to a mere remnant.

**TEPIC**, capital of the Territory of Nayarit, Mexico, 28 miles E. of the port of San Blas, with which it is connected by a railway. Situated on a plateau 3069 ft. above the sea, it commands a fine view of the Pacific. Its climate, mild and healthful, attracts many summer residents from San Blas. It has cotton and cigar manufactures. Pop., about 17,000.

**TEPIC**. See NAYARIT.

**TEPLICE-SANOV** (Ger. *Teplitz*), a town of Czechoslovakia, formerly belonging to Austria, 46 miles N.W. of Praha (Prague), in the valley of the Biela, between the Erzgebirge and the Mittelgebirge ranges. It is a favorite watering place, famous for its hot springs. It has important manufactures of machinery, hardware, buttons, cotton and india-rubber goods, chemicals, glass, pottery, and sugar. The town is known for the treaty of alliance signed there on Sept. 9, 1813, by the monarchs of Russia, Prussia, and Austria against Napoleon. Pop. (1947) 45,304.

**TERAMO** (anc. *Interamna*), a town of Italy, capital of the province of Teramo, on the Tordino, 84 miles S. of Ancona. Its cathedral (1355) has been modernized. Straw hats, pottery, and leather are manufactured, and silk is spun. Area of province, 750 sq.m.; pop. (about 225,000). Pop. of town, about 31,000.

**TERAPHIM**, a Hebrew word denoting idols, or household gods, associated with divination.

**TERATOLOGY** (Gr. *teratologia*, "a telling of wonders"), the branch of biological science dealing with abnormalities in fetal or embryonic development. Teratology unites the study of embryology with the techniques of pathology, and is sometimes called *pathological embryology*. Individual human beings are never completely alike at birth. The prenatal developmental differences between

human beings are only slight and are known as *normal variations*. Teratology does not deal with such normal variations but with developmental abnormalities which exceed the normal range. Congenital abnormalities, such as club foot, harelip, and cleft palate, are scientifically known as *anomalies* or *terata*: typical anomalies include *agenesis* or failure of development of an organ or other part, partial but incomplete development of an organ or part, exaggerated development, displacement of organs to abnormal locations, and fusion or splitting of organs normally split or fused, respectively. About 1 out of every 165 newborn children have major anomalies; a far greater number of fetuses and embryos which die before birth have such abnormalities.

Individuals possessing externally visible anomalies have, since ancient times, been known as "monsters" (Lat. *monstrum*, "omen of calamity") because the ancients believed that deformed infants were born to warn mankind of misfortune. Babylonian cuneiform inscriptions, dating from about 2000 B.C., list terata and the events that such abnormalities supposedly indicated. The ancient Romans and Hebrews believed that monsters were conceived by women during the menstrual periods. The ancient Greeks believed that anomalies were created by the gods to amuse themselves and to bewilder mankind; evidences of this concept exist in the English phrases "freak of nature" and "sport", which are often used to describe monsters. Modern superstitions regarding the cause of monsters emphasize external influences exerted upon the mother during the gestation period; for example, illness of or injury to a part or organ of the mother supposedly results in malformation of the corresponding part of the embryo.

The true causes of anomalies are numerous and may be classified according to whether the developmental disturbance is *internal* to the fertilized ovum, fetus, or embryo, or is produced by *external* forces. Among the internal causes of anomaly formation are: heredity, which governs the production of supernumerary fingers and of identical twins; inferior or superior quality of the protoplasm of the fertilized egg, resulting in arrested or accelerated development; physiological imbalance in the fetus which may produce mechanical distortions by overscretion of fluid; and influence of the development of one organ upon another whereby a slight malformation of one organ may cause more

extensive abnormalities in other organs developing at the same time. Among the external causes of anomaly formation are changes in external temperature, radiation, oxygen deficiency, maternal disease such as syphilis, delayed implantation of the fertilized egg in the uterus, and nutritional deficiency. Many scientists believe that harmful drugs, such as alcohol, narcotics, and lead, pass to the fetus from the mother and result in developmental disturbances.

*Twinning*. The development of identical twins is the best-known example of anomaly formation; twins are not, however, popularly regarded as monsters. In three out of every four pairs of twins produced, the infants result from the fertilization of two ova; such pairs are known as *ordinary* or *fraternal twins*, and may contain two males, two females, or one male and one female. In one out of every four pairs of twins, the infants result from a developmental disturbance within the fertilized egg which splits into two parts, each of which continues to develop. Such a developmental disturbance is usually caused by hereditary factors and occurs in one out of every 88 human pregnancies. The twins, known as *identical twins*, are of the same sex and resemble each other closely, having the same genetic constitution. Triplets, quadruplets, and quintuplets are developed in the same manner and are produced in one out of 7700 (roughly  $88^2$ ) pregnancies, one out of 681,500 ( $88^3$ ) pregnancies, and one out of 60,200,000 ( $88^4$ ) pregnancies respectively.

The abnormal nature of the development of identical twins becomes evident when the fertilized ovum does not split completely, and results in the development of "freaks", such as the Siamese twins, which are partially joined together. The Siamese twins, Eng and Chang (1811-74), were two brothers, born with a fleshy connection between them. The connection extended from the navel to the bottom of the breastbone of each; it was about  $1\frac{1}{2}$  inches wide on top and 3 inches wide on the bottom. The brothers were exhibited in sideshows in the United States and England and became wealthy; they married and had twenty-two children between them. Chang, having contracted pneumonia, died of this disease, and Eng expired two hours later. Many cases of joined identical twins have been observed but few have survived long after birth. Such twins may be joined at the chest, back, side, or rump; cases of twins joined at the head are

also known. The degree of separation of joined twins varies; the bond connecting Siamese twins may be slight, and in several similar recent cases successful operations have been performed to separate such twins; however, conjoined twins often share several essential organs, and separation cannot be performed without the death of at least one of the twins.

The nature of the twinning process also throws light on the occasional birth of children which have parasitic monsters attached to them. Such births are actually the result of incomplete twinning in which one twin develops normally, and the other twin, partially joined to its sibling, fails to develop completely. The fully developed child is scientifically known as the *autosite*; the incompletely developed twin is known as the *parasite*. Operations for the removal of the parasite from the autosite are often successful.

**External Anomalies.** Superficial anomalies, although often not as serious as malformations of the internal organs, are popularly best known and were responsible for the superstitions about "monsters" held by the ancients. Anomalies of the skull include: *cranioschisis*, or "open-roofed skull", in which the bones forming the roof of the braincase do not develop, and the brain is extremely reduced in size; *microcephalus*, in which the skull and braincase are abnormally small; *hydrocephalus* or *macrocephalus*, in which the brain swells during the accumulation of excessive cerebrospinal fluid, causing unusual enlargement of the skull; *scaphocephaly*, in which the skull becomes wedge-shaped because of premature suturation of some of the skull bones while others continue to grow; *acrocephaly*, or pointed skull; and *plagiocephaly*, or twisted skull.

Anomalies of the face include: *aprosopus*, in which the features never develop; *synotus*, in which the ears are located close together in the neck region (usually associated with *agnathus*, in which the chin is absent); *anophthalmia*, in which the eyes are absent; *cyclopia*, in which only one eye is present, usually in the middle of the forehead; an anomaly of the nose associated with cyclopia, in which the nose becomes a tubular proboscis located above the central eye; *harelip*, in which the upper lip is cleft; *cleft palate*, in which the upper jaw is split; abnormalities in the size, number, shape, and location of the teeth; absence of the tongue or division of the tongue into two or three lobes;

*macrostomia*, in which the mouth slit is too large; *microstomia*, in which the mouth slit is abnormally small; *astomus*, in which the mouth opening is completely closed; and *micrognathus*, in which the lower jaw is abnormally small.

The major external anomalies of the trunk are *gastroschisis*, in which the abdominal wall does not close, often accompanied by herniation of the internal organs, and *rachischisis* or cleft spine, a similar condition of the spinal column. Anomalies of the breasts include *amastia*, or absence of breasts, *hypermastia*, in which additional breasts are present, *hyperthelia*, in which only additional nipples are present, and *gynecomastia*, occurring in males, in which the breast is of a female type. Embryonic tails as large as 3 inches in length have been observed on newborn infants.

The best-known anomalies of the limbs are *clubfoot* and *clubhand*. In *amelus*, the limbs fail to develop or appear as short stubs; in *hemimelus* the upper portion of the limb is normal, but the lower portion is a stump. In an analogous condition, *phocomelus*, the upper portion of the limb does not develop, the complete lower portion of the limb arising directly from the trunk like the flipper of a seal. Other anomalies of the limbs include: *sympodia*, in which the legs are united; *polydactyly* and *dichirus*, in which one or more additional digits appear on the hands or feet; *syndactyly*, in which the digits are united by a connection of bone or a webbing of flesh; *brachydactyly*, in which the digits are abnormally short; and *hyperphalangism*, in which the digits are abnormally long.

Excessive congenital hairiness is known as *hypertrichosis*; congenital absence of hair is known as *hypotrichosis*. *Anonychia*, or the congenital absence of nails, has also been observed. Deficiency of skin pigmentation, or *albinism*, and excess of pigment, or *melanism*, are well-known skin anomalies.

**Internal Anomalies.** Anomalies of the internal organs are often much more dangerous to life than external malformations. Physicians are learning to recognize the outward signs of visceral malformation prejudicial to health, and are just beginning to develop operative techniques to correct such malformations. The "blue-baby" operation, devised toward the close of the first half of the 20th century, corrects one such malformation: a persistent connection between the artery leading from the heart to the lungs

and the artery leading from the heart to the body, resulting in the circulation of stale blood through the body of the infant. Malformations of internal organs are discussed below in relation to the systems these organs comprise.

Malformation of the brain is usually associated with anomaly of the skull; virtual absence of the brain, or *anencephaly*, herniation of the brain, or *encephalocele*, and herniation of the brain membranes, or *meningocele*, are usually associated with deficient closure of the roof of the skull. The brain may be unusually small or unusually large. The spinal cord is sometimes absent (*amyelia*) or may protrude through a cleft spine as in *spina bifida*. The peripheral nerves often show anomalies in number and position, but few of these anomalies are serious.

Anomalies of the endocrine system are frequent; accessory thyroid, parathyroid, and suprarenal glands often occur in the human. The ovaries and testes are discussed below in the paragraph on anomalies of the reproductive system.

The digestive system is very subject to malformation. One of the commonest anomalies of the digestive system is *situs inversus*, in which organs normally placed on the right side of the body occur on the left side and organs normally occurring on the left side of the body are located on the right side. Organs in the thoracic cavity are often affected by this reversal in the abdominal cavity. *Stenosis*, or narrowing of the opening, and *atresia*, or complete closure of the opening, occasionally affect the esophagus, stomach, or intestines, and must be treated surgically. A fistula, known as *Meckel's diverticulum*, occurs as a blind sac leading from the ileum toward the navel in about two percent of all adults. In some cases the fistula penetrates the body wall, opening to the outside, and is then called an umbilical fecal fistula. An imperforate or closed anus occurs in a small number of infants; provision for excretion must be made surgically. Absence or duplication of the gall bladder sometimes occurs, and accessory pancreases and split pancreases are well known.

The lung is subject to wide variations in the number and size of its lobes. The most serious respiratory anomaly is the presence of a fistula or open connection between the windpipe and the esophagus. The diaphragm is occasionally pierced by a hole, resulting in herniation of the abdominal organs into the pleural cavity.

The condition producing "blue babies" is the most common anomaly of the heart and blood vessels, occurring in about 1 out of every 4 infants; the degree of severity of this condition is only rarely great enough to produce serious symptoms. Anomalies of the arteries and veins are common, but rarely interfere with the life processes. The spleen is occasionally split or duplicate.

The kidneys are subject to several serious terata. Occasionally a kidney fails to develop altogether or is hypoplastic, that is, excessively dwarfed in size; rarely, excess kidney tissue is present. The two kidneys are sometimes joined at their lower ends, and are then known as "horseshoe kidney". Sometimes a kidney fails to descend and remains in the pelvis; such a kidney is called an ectopic or pelvic kidney. *Polycystic kidney* are usually congenital, and produce painful symptoms resulting from enlargement of cysts and compression of neighboring kidney tissue. The ureters may not open into the bladder but lead directly into the urethra, rectum, uterus, or vagina.

Anomalies of the reproductive system are extremely important because of their psychological effect on the afflicted individual. Every case of mammalian "hermaphroditism" (see HERMAPHRODITISM) is produced by developmental failure. Until the fifth to the sixth weeks of embryonic life, the sex organs of the embryo give no indication as to the future sex of the embryo; the gonads are generalized in structure, and both male and female sex ducts are present. In the development of a normal individual of a specific sex the gonads and secondary sex organs predominate in that sex develop, and the secondary sex organs of the other sex degenerate. In anomalous development, secondary sex organs of both sexes develop almost equally, or sufficiently so that primitive organic characteristics of the usually suppressed sex are recognizable, a condition called pseudohermaphroditism. The presence of male or female gonads determines whether the individual is a male or female pseudohermaphrodite, respectively. In lower mammals, hermaphrodites possessing both testicular and ovarian tissue have been known to occur; true hermaphroditism of this sort almost never occurs in man. Congenital absence of gonads or duplication of gonads is also rare. *Cryptorchism*, or failure of the testes to descend into the scrotum from the abdominal cavity, is a common anomaly and may accompany malformation of the male external genitalia.



Metropolitan Museum of Art

*"A Lady Playing the Theorbo," painting by Gerard Terborch*

Common anomalies of the internal female reproductive system include duplication of the uterus and vagina, presence of a partitioned uterus, and narrowing or closure of the vaginal canal, often accompanied by an imperforate hymen. Complete absence of one or both Fallopian tubes, of the uterus, or of the vagina occurs rarely, usually accompanying malformation of the external genitals.

Although anomalies of the genitalia are externally visible, they are discussed here, rather than in the section on external anomalies, because of their close association with the internal development of the reproductive system. In extreme cases, the external genitalia and other secondary sexual characteristics completely resemble those of one sex, and the gonads are those of the other sex. Such false hermaphroditism or pseudohermaphroditism occurs much more frequently in males than in females. The penis is rarely absent, but is often rudimentary, resembling a clitoris. Often, the urethral canal fails to fuse on the underside of the penis, causing a condition known as *hypospadias*; when this

condition is accompanied by failure of fusion of the two halves of the scrotum, the appearance of the genitals is typically feminine. Sometimes, the urethral canal is open on the upper side of the penis, a condition known as *epispadias*. In female pseudohermaphroditism, the labiae may be large or fused and the clitoris overdeveloped. See REPRODUCTIVE SYSTEM.

**TERBIUM**, a metallic element of atomic number 65, atomic weight 159.2, and symbol Tb, the least abundant member of the group of elements called rare earths (qv). It was discovered in 1843 by the Swedish chemist Carl G. Mosander, but has not yet been isolated in pure form. Terbium ranks 51st in order of abundance among the elements of the earth's crust, and is found in small quantities combined with cerite, gadolinite, and other rare earth minerals. It yields several colorless or white salts and a white oxide known as terbia,  $Tb_2O_3$ .

**TERBORCH**, or **TER BORCH**, GERARD (1617-81), Dutch painter, born in Zwolle. The influence of Frans Hals is noticeable in his

first dated picture, "Consultation" (1635, Berlin-Museum). To the same period may be assigned the "Knife-Grinder's Family" and "Boy with a Dog" (Pinakothek, Munich). In 1635 he went to England, where he painted several portraits of William III. In 1646 he went to Münster, Westphalia, where he painted his most celebrated work, the "Peace Congress of Munster" (1648, National Gallery, London), containing sixty likenesses, a perfect specimen of miniature portrait painting, and one of the most imposing historical works in Dutch art. From 1651 till 1680, having returned to Holland, he painted a series of genre and small portrait subjects, considered unexcelled in Dutch or any other art.

**TERCE.** See BREVIAIRY.

**TERCEIRA**, the second-largest island of the Azores. See AZORES.

**TEREBRATULA**, name properly applicable to certain species of brachiopods of the Mesozoic and Tertiary fossil shells which are closely allied to *Terebratula philipsi* of the Middle Jurassic. This group appeared in the Devonian, and, with a great expansion during the Mesozoic, it continues to the present day. As a rule the shells have a pentagonal or oval outline, with both valves convex, the ventral beak prominent and arching over the dorsal beak and perforated by an unusually large foramen. The earlier species are smooth-surfaced shells, while those of the Mesozoic are sometimes striated, and, in a few instances, plicated.

**TEREDO.** See SNIPWORM.

**TEREK**, a river of s.e. Russia, one of the chief streams flowing from the Caucasus. It rises in a glacier near the summit of Mount Kazbek at an altitude of nearly 14,000 ft and descends the n. slope of the Caucasus in a tumultuous course through deep and narrow gorges. It then turns e. and after a flow of 400 m. enters the Caspian Sea through a large delta. The river is navigable 254 m. for small vessels.

**TERENCE**, or (Lat.) **PUBLIUS TERENTIUS AFR** (190?-159? B.C.), Roman playwright, born in Carthage. He was taken to Rome as the slave of the senator Publius Terentius Lucanus, who educated him and later manumitted him. On gaining his freedom he assumed his patron's *nomen*, Terentius. His first play was the *Andria*, produced in 166 B.C. Its success was immediate, and Terence, who had an engaging personality, soon became a favorite among Roman literary circles. He is said to have been an intimate friend of Publius Cornelius Scipio (q.v.) Æmilianus, in

whose circle were statesmen and men of letters concerned with improving and refining the Latin language. Terence's six comedies, produced between 166 and 160 B.C., are all *fabula palliata* (see *PALLIATA*, *FABULA*), or comedies based upon Greek originals. Of these, the *Andria*, *Heautontimorumenos*, *Eunuchus*, and *Adelphæ* are derived from comedies by the Greek dramatist Menander (q.v.), and the *Phormio* and the *Hecyra* are modeled upon originals by the Athenian playwright Apollodorus of Carystus (300-260 B.C.). In 160 B.C. Terence made a journey to Greece, to search for additional plays by Menander, and died the following year on his way home.

Terence's comedies, unlike those of his famous predecessor Titus Maccius Plautus (q.v.), contain little song and dance, they lack the broad farce inherent in the works of Plautus, and their humor, rather than being derived from puns and wordplay, exaggerated characterization, and laughable situations, arises out of a subtle handling of both plot and character. There is less use of trickery than in the works of Plautus, and more of mistaken identity and recognition; with the exception of the *Hecyra*, the plot is always double, with two love affairs being interwoven and the happy solution of one usually dependent upon the outcome of the other. Terence introduced greater suspense into ancient comedy, resulting in part from his abandoning the customary use of the prologue to disclose the plot, and instead utilizing it as a defense against unfavorable criticism. His work is more Greek than Roman in quality, and the plays include no allusions to Roman localities or events. Terence had high ideals of artistic perfection, bringing elegance and restraint to the Latin language and was praised later by Gaius Julius Cæsar as "a lover of faultless speech". Although less a master of comic devices and techniques than Plautus, Terence had a great influence upon Renaissance comedy; the French dramatist Molière made adaptations of the *Phormio* and the *Adelphæ*, and through him Terence's comedies influenced English playwrights of the 17th and 18th centuries.

**TERENTIANUS MAURUS** (fl. late 2nd century A.D.), Roman grammarian and poet, born in Mauretania. His extant treatise on prosody and the various meters, composed chiefly in hexameters, was divided into three parts entitled *De Litteris*, *De Syllabis*, and *De Metris*. The third part, that on meters, is the most important, but has been incom-

pletely preserved. The work was much used by later writers on prosody.

• **TERESA, SAINT** (1515-82), famous Carmelite nun and mystical writer, born in Avila, in Old Castile. In her eighteenth year she entered a convent of the Carmelite Order. After a time her religious exercises reached a most extraordinary degree of asceticism. She began her work of reforming the Carmelite Order in Avila, Spain, but afterward removed with her little community to St. Joseph's, where she established in its full rigor the ancient Carmelite rule (1562). The general of the Carmelite Order, J B Rossi, was so struck with the condition of the convent that he urged upon her the duty of extending throughout the Order the reforms thus successfully initiated. Teresa entered upon the work with great energy, and succeeded in carrying out her reforms. (See CARMELITES.) She was canonized by Gregory XV in 1622, her feast day being fixed on October 15. Her works consist, besides her famous letters, mainly of ascetical and mystical treatises.

**TERESA OF LISEUX** ("Little Flower of Jesus"), SAINT (1873-97), Carmelite nun, born in Alençon, France. In 1888 she entered the Carmelite Order in Liseux and in 1895 was made mistress of the novices. She was remarkable for her piety and for her patience in enduring suffering caused by pulmonary hemorrhages. In 1925 she was canonized; her feast day is October 3. Her cult is widespread, with special appeal to priests and missionaries.

**TEREUS**, in Greek mythology, a king of Thrace who seduced Philomela, the sister of his wife Procne, and then cut out her tongue. The two sisters, in retaliation, served Tereus the flesh of his son Itys at a banquet. According to legend, Tereus was later transformed into a hawk. See PHILOMELA.

**TERGOVISTE** or **TARGOVISTE**, a city in the region of Walachia, Romania, situated on the Ialomița R., 45 miles n.w. of Bucharest. It was capital of the principality of Walachia from 1383 to 1698, with a population of 60,000 in the 16th century. Pop., about 22,000.

**TERHUNE, ALBERT PAYSON** (1872-1942), American writer, born in Newark, New Jersey, and educated at Columbia University. In 1893-94 he made an extensive tour on horseback through Syria and Egypt, living for a time among the nomadic Bedouins of the Syrian desert. From 1894 to 1916 he served on the editorial staff of the New York *Evening World*. Terhune is remembered prin-

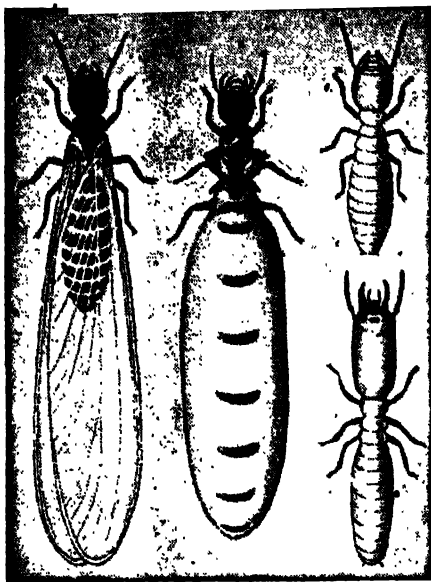


*Ecstasy of Saint Teresa* (sculpture by Lorenzo Bernini in Santa Maria church in Rome)

cipally for his stories about dogs. His works include *The Fighter* (1909), *Lad: A Dog* (1919), *Bruce* (1920), *Buff: A Collie* (1921), *His Dog* (1922), *The Heart of A Dog* (1926), *Lad of Sunnybank* (1928), *The Way of A Dog* (1934), and *A Book of Famous Dogs* (1937).

**TERHUNE, MARY VIRGINIA** (HAWES) (1831-1922), American novelist and journalist, born in Richmond, Va. She published under the name of Marion Harland many domestic manuals, social essays, sketches of travel, novels, and short stories, among which are *Looking Westward* (1914) and *The Long Lane* (1915).

**TERLIZZI**, a town in the province of Bari delle Puglie, Italy, 20 miles n.w. of Bari. It has an ancient castle, and is active commercially. Wine and almonds are leading products. Pop., about 22,000.



THE TERMITE. Left: Male. Middle: Female after impregnation. Right, top: Worker. Right, bottom: Soldier.

**TERM**, in legal practice in the United States, the period of time in which a court holds session, and, in some jurisdictions, the divisions of a court, as a "special term" or "trial term". In some States having codes of civil procedure, for the purpose of more expeditious handling of litigation, a court is divided into a special term for the hearing of motions and a trial term for the hearing of cases. In New York City, an appellate term, or a court consisting of three judges of the supreme court, hears appeals from the municipal courts. Generally the times during which a court holds sessions are arranged with reference to the number of judges available and the probable volume of work to be handled.

In the law of real property in England and the U.S., the word "term" is used to designate the time for which a tenant is granted an estate, as a term of years under a lease.

**TERMINI IMERESE** (anc. *Thermæ Himerenses*), a seaport in Palermo Province, on the northern coast of Sicily, situated 23 m. by rail E.S.E. of the city of Palermo. Important fisheries are located there. The chief industry of the city is trade, and exports include olives, olive oil, macaroni, and corn. A technical school, a navigation school, and

an art gallery are situated in the city. Ruins of ancient baths, a theater, and an aqueduct can still be seen. Termini Imerese is also the site of hot springs, which were famous in antiquity and in which Hercules is said to have bathed. The city was founded by Carthaginians in 409 B.C. about 8 miles W. of Himera (q.v.). Agathocles, Tyrant of Syracuse, was born there. The city remained a Carthaginian possession until it was taken by the Romans during the First Punic War. Pop., about 21,000.

**TERMINUS**, in Roman religion, a divinity presiding over public and private boundaries, and represented by a stone or post set in the ground. His only sanctuary was in the Temple of Jupiter on the Capitoline Hill, at which he was honored in the form of a boundary stone, set under an opening in the roof so that his rites might be considered to be performed in the open air, as the ritual required. Originally Terminus seems to have been identified with Jupiter, but gradually he came to be considered a separate and distinct god. The *Terminalia*, celebrated on February 23, appears to have been simply a festival of neighbors at their common boundary lines. Although annual sacrifices are known to have been made at the frontier of the early Roman state, dedications to Terminus are unknown before the days of the Roman Empire. "Termini" or "terminal figures" are names applied to boundary marks consisting of a stele or upright stone carved at the top into the likeness of the head of the god. Such stones were imitated in Italy during the Renaissance as decorations for the corners of parterres or other garden divisions.

**TERMITES** (*Termitidae*), any one of the insects of the order Isoptera, comprising those forms known as white ants. They are not at all related to the true ants, but their general appearance and the fact that they live in societies have given them the popular name. Like the ants, the termites are social insects, living in colonies and building nests or hills. They are widely distributed in tropical countries, but they also occur in the temperate parts of North and South America, and a few have established themselves in Europe.

The termite society consists for the most part of wingless, sexually immature workers, and a less numerous caste of large-headed, strong-jawed soldiers. The workers collect food, form burrows and tunnels, build hills, and care for the males, females, eggs, and larvae. The males and females have wings, which the latter lose after impregnation.



In general appearance and size a wingless termite is antlike, but the winged forms are much larger and flatter, and their wings are quite different.

The nests, often built of earth, are hard and persistent, and sometimes more than 12 ft. high. These ant hills are divided into chambers and galleries, and there are generally two or three roofs within the dome-shaped interior. The thick walls are perforated by passages leading to the nurseries and storehouses. Termites sometimes attack the woodwork of houses and soon reduce the thickest timbers to a mere shell. Those species which live in trees sometimes construct nests of great size, like sugar casks, of particles of gnawed wood cemented together and very strongly attached to the branches.

In the United States there are comparatively few species, and only one, *Termes flavipes*, which has a northward range. This is the common white ant found frequently living in the joists and other large timbers of houses. The most remarkable termitaries are those of *T. bellicosus*, abundant on the w. coast of Africa. They are sugar-loaflike in shape, 10 to 20 ft. in height, and, though built of cemented particles of earth, are strong enough to bear a man's weight.

**TERMONDE** (Flem. *Dendermonde*), a town of Belgium, in the province of East Flanders, situated at the confluence of the Dender and Scheldt rivers, 18 miles n. of Ghent and 25 miles s.w. of Antwerp. Its famous Church of Notre Dame contains celebrated paintings by Anthony Van Dyck and Caspar de Crayer, and has 12th century fonts. Industries in Termonde include bleaching and the manufacture of leather goods, cottons, carpets, and soap. In 1667, during the so-called War of Devolution, the town was besieged by the French, who were compelled to retreat when the inhabitants opened the dikes and flooded the countryside. During World War I the town and its old church suffered considerable damage. Pop., about 9500.

**TERN**, one of a group, the Sterninae, of small shore birds, found in most parts of the world, resembling gulls in habits and appearance. About 75 species are known, varying in size from the Caspian tern, *Sterna tschegra* or *caspia*, which is nearly 2 ft. long and 4½ ft. across the wings, down to the dainty least tern, *S. antillarum*, which is only 9 in. long. The typical color of the terns is blue gray above, white beneath, and black on the crown, but one or two species are



Arctic tern (*Sterna paradisaea*)

pure white, some are black and white, some sooty brown, and some almost wholly black. The common tern is *S. hirundo*, abundant on the coasts of the whole Northern Hemisphere and of Africa. It breeds locally on the coast and in the Mississippi Valley from the Gulf States to Greenland, but, owing to incessant persecution, it selects only unoccupied sandy islets for its breeding places. The sooty tern, or egg bird, of the West Indies, *S. fuliginosa* or *fuscata*, and the elegant tern, *S. elegans*, of the Pacific coast, are among the most interesting of the 15 or 16 other North American species.

**TERNATE**, a small island of the Moluccas. Area, about 25 sq. m. See *MOLUCCAS*.

**TERNAUX-COMPANS**, HILARI (1807-64), French historian, born in Paris. After holding several diplomatic posts, he devoted the rest of his life to a series of valuable works on early American history. Among these are *Voyages, Relations et Mémoires Originaux pour Servir à l'Histoire de la Découverte de l'Amérique* (1836-40) and *Histoire du Mexique par Don Alvaro Tlaximac* (1849).

**TERNI**, a cathedral city in the province of Perugia, Italy, 70 miles n.e. of Rome. It has large iron and steel works. About 2 m. away is the famous cataract of Velino, 650 ft. high, celebrated by Byron in his *Child Harold*. Terni is the ancient *Interamna Umbra*, perhaps the birthplace of Tacitus, and has many interesting Roman remains. Pop., about 63,000.

**TERNSTROEMIACEAE**, a family of polypetalous plants, consisting of trees and shrubs, natives of warm and temperate countries. They are most abundant in South America; a few are found in North America; some in India, China, and the Indian Archipelago. The leaves are alternate, leathery, in many species evergreen, generally undivided

and sometimes dotted. This order is very important as containing the Frashubs. It is also interesting because of the great beauty both of the foliage and flowers of many of the species of which the genus *Camellia* affords the best known examples.

**TERPANDER** (fl. 7th century B.C.) Greek musician and poet born in Antissa on the island of Lesbos. He went to Sparta and in 676 B.C. was crowned victor in the first musical contest at the *Carmea* & Spartin festival in honor of the god Apollo. Terpander established the first music school in Greece and is credited with increasing the number of strings on the lyre from four to seven (see *LYRE*). He was also probably the first to set poetry regularly to music and is hence regarded as the father of Greek lyric poetry.

**TERPENES**, unsaturated compounds of the composition  $C_nH_{2n-2}$  yielded by plant or built up by organic synthesis. They are divided into the following groups: (1) *hemiterpene*  $C_{10}H_{16}$  consists of 10 carbon chains from which the well known geraniol or citral is a derivative, (2) *terpene*  $C_{20}H_{32}$  ring forms familiar as pinene and limonene (3) *sesquiterpene*  $C_{15}H_{24}$  contained in oils of clove, cedar, hops, patchouli, etc. (4) *polyterpenes*  $C_{40}H_{64}$  principally occurring as crutchouc or rubber and (5) *isoprene* or methyl butadiene  $C_4H_6$  chiefly important as the starting point for the synthesis of rubber.

**TERPSICHOE**, in Greek mythology one of the nine Muses (qv). She presided over choral dance and song. In a latter assignment of functions to the Muses, she was regarded as the muse of the lesser lyric poetry and her symbol was the lyre. From her name is derived the modern term for a dancer "terpsichorean."

**TERQUEM**, OLRY (1782-1862), French geometer born in Metz of Jewish parents. In 1804 he was called to Mainz as professor of mathematics in the Lyceum and afterward to a similar position in the school of artillery. Returning to Paris in 1814, he was appointed librarian in the artillery depot at Saint Thomas d'Aquin. He was cofounder with Gerono of the valuable *Nouvelles Annales de Mathematiques* (1842).

**TERRA ALTA**, a city of Preston Co., W. Va. situated about 45 miles N.E. of Clarksburg. The city, which lies in a picturesque mountainous region, is a summer resort and the trading center of the surrounding agricultural area. Transportation facilities include a railway and the city is the site of a hosiery mill. The Hopemont State Tuberculosis San-

atorium is 2 mi. to the E. Pop. (1950) 100.

**TERRACES**, in geology, comparatively level strips of land near the sea, like rivers with a sharp descent at the edge toward the water, showing in ancient water level. The drift terraces so common in the northern States are remnants of flood plains that were formed when the great ice streams of the glacial period filled their present valley. Lake terrace marks former shoreline and the evidence of a shrinkage in the volume of the lakes. They are well marked around most of the Great Lakes, the shore of Lake Champlain and Lake of the Great Bear. Their abundance has suggested the term *terrace epoch* to designate the geological period during which they were produced.

**TERRACINA** (anc. *Turris*) city in the province of Roma Italy, 65 mi. by rail S.E. of Rome on the Tyrrhenian Sea and at the S. end of the Pontine Marshes. In ancient times part of the city occupied a commanding position on the crest of a hill overlooking the lower city, the site of the modern town. The higher section known also in antiquity as Anxur, afford a magnificent view and has interesting remains of the Roman period dating from 100 B.C. notable are those of an amphitheater and an imposing temple of Venus which until 1874 were supposed to be long to pulice of Theodor the Otter. The 13th century Cathedral of Saints Pietro and Cesario in the modern town a building of much architectural beauty is situated on the site of another Roman temple and the present piazza occupies the ancient forum. Pop. about 110,000.

**TERRA-COTTA**, in Italian term for earthenware. Statues, statuettes, bas-reliefs and architectural members such as columns, cornices, friezes, consoles and the like made of burnt clay are said to be executed in terra cotta whether they are ancient or modern. The color is either buff yellow or red. Many masterpieces of ancient Greek and Roman sculpture are executed in this material and many works in burnt clay by Italians of the Middle Ages and early Renaissance periods are exquisite productions.

Some of the best terra cotta for buildings is made in the United States, and here also color has been sparingly used. Among its advantages as a building material are the ease with which it may be molded to any desired architectural or sculptural form and indefinitely repeated its durability, lightness, strength and cheapness. It may be made in

almost any desired color, but is usually dark red.

**TERRAIN**, a word of French origin, meaning the ground, and the configuration thereof, where military operations are conducted.

**TERRAPIN**, the popular name of many species of fresh-water and tidal-water tortoises of the family Emydidae, natives of tropical and the warmer temperate countries. The family is represented in the United States by about twenty species. The word "terrapin" has no exact scientific significance, but in the United States it is most commonly applied to the diamond-back terrapin, *Malaclemmys centrata* or *palustris*. This species is found in salt marshes from New York to Texas, and is gray with black markings. Its flesh is highly esteemed as a table delicacy, and in some places along the southern coast large numbers of these turtles are reared for market in inclosures.

**TERRAZZO**, a kind of flooring much used in modern practice for corridors and floors of public buildings. It is composed of small fragments of marble set in a white cement and rubbed to a polish after it has set. By the use of fragments of different colors decorative effects of mosaic may be produced. The process and the name are derived from Italy, where it is called "terrazzo Veneziano".

**TERRE HAUTE**, county seat of Vigo Co., Ind., situated on the Wabash R., 73 miles w.s.w. of Indianapolis. It is served by four railroads, and maintains a municipal airport. Terre Haute is an important railroad and manufacturing center, and the commercial center of an area noted for farming and the production of coal, oil, and clay. Among the industrial establishments in the city are extensive railroad shops, rolling mills, printing and engraving plants, paper mills, distilleries, breweries, food and meat packing plants, and factories manufacturing chemicals, paints and varnishes, brick, drain tile and other clay products, glass, tin cans, coke by-products, wooden boxes, iron and steel products, metal stampings, bronze and brassware, machinery, and food products. Terre Haute is the site of Indiana State Teachers College, established in 1870; Rose Polytechnic Institute (1874), the oldest engineering college w. of the Allegheny Mts.; St. Mary-of-the-Woods College (1840), for women; and a Federal penitentiary. The municipal park system comprises eighteen parks, including swimming pools, golf courses, a zoo, a fish hatchery, and a stadium with a seating capacity of 20,000 persons.

Fort Harrison, named in honor of Gen

William Henry Harrison, first Territorial governor of Indiana, was built on the site of the present city in 1811. The following year, while under the command of Captain Zachary Taylor, the fort was successfully defended against an attack led by the Indian chief Tecumseh. The settlement which developed around the fort was incorporated as a town in 1838 and as a city in 1853. It was the birthplace of Eugene V. Debs, noted Socialist leader, of the writer and editor Theodore Dreiser, and of Paul Dreiser, brother of Theodore Dreiser and writer of the song *On the Banks of the Wabash*. Pop. (1950) 64,214.

**TERRELL**, a city of Kaufman Co., Tex., situated 32 miles E. of Dallas. It is served by two railroads, and contains railroad repair shops. The city is the commercial center and shipping point of an area noted for the production of livestock, dairy products, cotton, wheat, oats, vegetables, and fruits. Industrial establishments in the city include cotton gin, and compresses, cottonseed-oil mills, plants processing milk products, and factories manufacturing brooms, mattresses, dresses, aprons, and sunbonnets. Terrell is the site of the State hospital for the insane, and of Texas Military College, a junior college established in 1915. The city was founded in 1873 and chartered in 1874. Pop. (1950) 11,544.

**TERRESTRIAL ELECTRICITY**, the science pertaining to electrical phenomena exhibited by the earth and atmosphere. Under normal conditions the surface of the earth is everywhere negatively charged, and the magnitude of the charge density is such that the potential gradient or increase of electrical potential per meter increase of altitude above the surface, amounts to about 150 volts per meter. The potential gradient shows annual and diurnal variations of very considerable amount. It diminishes with increase of altitude, and probably becomes sensibly zero at altitudes of little more than 10 kilometers. The atmosphere possesses the power of conducting electricity to an extent which, though extremely small, is nevertheless sufficient to insure that nine tenths of the charge on the earth would disappear in 10 minutes if there were no means of replenishing the loss. Although many attempts have been made to account for the permanent existence of an electrical field in a conducting atmosphere, no completely satisfactory theory has yet been evolved. Instruments used in the measurement of earth currents include the declinometer, the dipping needle, and the electrometer.

**TERRESTRIAL MAGNETISM:** See MAGNETISM; TERRESTRIAL.

**TERRIER**, any of several breeds of small dogs originally employed for hunting small, furred game. Terriers hunt by digging into the ground at the hiding place of the game and then fighting the game underground or driving it out of its place of concealment. They are now kept principally as pets. The principal breeds of terrier are the Airedale, Bedlington, Boston, Bull, Dandie Dinmont, Fox, Irish, Kerry Blue, Manchester, Schnauzer, Sealyham, Skye, Staffordshire, Welsh, and Yorkshire (qq.v.).

**TERRISS**, WILLIAM, real name WILLIAM LEWIN (1847-97), English actor, born in London. He made his first appearance as an actor in Birmingham in 1867. Immediately successful, he appeared in the London theaters in the following year as Lord Cloud-rays in Robertson's *Society* (1878), Chateau-Renaud in *The Corsican Brothers* (1880), and in Shakespearean roles. He made an American tour with Sir Henry Irving in 1883, and one with Miss Millward in 1889. He was assassinated by a madman. His daughter, ELLALINE TERRISS, also became well known as an actress, playing with her husband, Seymour Hicks.

**TERRITORIAL COURTS**, in the judicial system of the United States, courts established as U.S. District Courts in the Territories; the most important of such courts are those for Puerto Rico, Alaska, Hawaii, the Canal Zone, and the Virgin Islands. In addition to their functions as District Courts, some of the courts exercise jurisdiction over purely local matters and controversies. Authority to define the jurisdiction of the Territorial Courts may be delegated by Congress to the Territorial governments.

**TERRITORIAL WATERS**, in international law, waters subject to the jurisdiction of a sovereign state, as distinguished from high seas (q.v.), and consisting of waters lying within the state, waters which are boundaries between states, and coastal waters. Jurisdiction over boundary waters, such as lakes or rivers, is fixed by treaties; the limit of each state's jurisdiction is usually an imaginary line drawn through the center of such waters. In the United States each State exercises jurisdiction over waters lying wholly within the State; such streams which form part of the system of interstate waterways are, however, subject to the control of the Federal government. With respect to territorial waters on the coast of a state, the

theory of international law formerly was that the jurisdiction of such a state extended along its coast for three miles from low-water mark. The theory was based on the cannon shot of the period; since such an area was within the range of a cannon it was deemed subject to control from the shore. Though conditions of warfare have changed, the three-mile limit is still the accepted limit of territorial jurisdiction; however, for revenue purposes, especially for the protection of special industries, such as fishing, various limits beyond the three-mile limit have been claimed from time to time. Thus, during the early 1930's, in connection with prohibition enforcement, the jurisdiction of the United States over coastal waters was extended by international treaties to twelve miles from the coast. The general rule is that arms of the sea which are not more than ten miles wide are considered territorial waters; greater widths have, however, been so considered as the waters of Concepcion Bay, Newfoundland, where the headlands are 20 m. apart.

The concept of jurisdiction by a state over its territorial waters implies that no other state can exercise any rights there, as of fishing, except by permission. A state has the right to refuse access to armed vessels of other states; merchant vessels of belligerent nations entering such territorial waters become subject to the jurisdiction of that state. As a general rule, all nations possess a common right of navigation on territorial waters. The regulation of navigation over territorial waters which serve as means of communication between two portions of the high seas, including such straits as the Dardanelles and the Bosphorus, and such passages as the Suez and Panama canals, is fixed by international treaties.

**TERRITORIES**, the name given in the United States to certain parts of the national domain which have not been erected into States. They are the District of Columbia and Alaska on the continent, and Hawaii, the Samoan Islands, and Guam in the Pacific. Puerto Rico, now a Commonwealth, was a U.S. Territory until 1952. They may be classified, under their present status as political bodies, as (1) unorganized Territories; (2) the Federal District; and (3) the insular possessions. The Territories are not regularly represented in Congress, but are allowed to send a delegate, who is given a seat in the House of Representatives with a right to take part in the debates, but not to vote. For the government of Alaska,

Hawaii, the District of Columbia, Puerto Rico, and the Samoan Islands, see separate articles under these titles. The Virgin Islands, a dependency in the West Indies, and the Panama Canal Zone are not classed as Territories. The Canal Zone has the status of a military reservation.

By the United States Constitution the national Congress is given power "to make all needful rules and regulations respecting the territory or other property belonging to the United States". From the beginning this clause was construed as giving the powers incident to jurisdiction as well as to ownership, and even before the adoption of the Constitution the Northwest Territory was regularly organized by the old Confederation Congress, which for this purpose passed the famous Ordinance of 1787. This ordinance served as the model for much of the subsequent legislation in the same field, though there were a number of important variations. See UNITED STATES OF AMERICA.

**TERRITORIES, OFFICE OF**, agency of the U. S. Department of the Interior, established in 1950, and vested with responsibility for all departmental matters pertaining to Territorial affairs. The agency has jurisdiction in matters relating to Territories, island possessions, trusteeship areas, and dependent areas under U. S. sovereignty. Prior to 1950 the functions of the agency were performed by the Division of Territories and Island Possessions, created in 1934. The Office of Territories assists the Territorial governments in working out plans and policies for the establishment of sound economic conditions and of political relationships with the United States satisfactory to the local populations of the Territories. The office also acts as a liaison agency between the Federal government and Territorial governments. Among the functions specifically assigned to the office are supervision of the operation of the Alaska Railroad, the Alaska Road Commission, and the Puerto Rico Reconstruction Administration. The office is administered by a director appointed by the President with the approval of the Senate.

**TERROR, REIGN OF**. See FRENCH REVOLUTION; REIGN OF TERROR.

**TERRY, ALFRED HOWE** (1827-90), American soldier, born in Hartford, Conn. He began to practice law (1849), and was clerk of the Superior and Supreme courts of Connecticut (1854-60). He was in command of the 2nd Connecticut Militia at the outbreak of the Civil War and participated in the first

battle of Bull Run. He was promoted to the rank of brigadier general, of volunteers, in 1862, and in 1864 he was given command of the Tenth Corps of the Army of the James. In January, 1865, he commanded the second, and successful, Fort Fisher expedition. Soon afterward he occupied the city of Wilmington, N. C., which had been the last refuge of the blockade runners. For his services he was commissioned major general of volunteers, and brigadier general and brevet major general in the regular army. From June, 1865, to August, 1866, he commanded the Department of Virginia. He was then placed in command of the Department of Dakota, and in 1876 he commanded the main column which drove Sitting Bull and his followers into Canada after the massacre on the Little Big Horn. Later he commanded the Department of the South and the Military Division of Missouri. He retired in 1888.

**TERRY, DAME ELLEN (AICE)** (1848-1928), English actress, born in Coventry. Her first appearance on the stage was as the boy Mamillius in Charles Kean's revival of *A Winter's Tale*, at the Princess's Theatre in 1856. In 1863 she made her appearance at the Haymarket in London. In 1875 she joined the Bancrofts at the Prince of Wales's Theatre. In 1878 she began her long association (24 years) with Henry (later Sir Henry) Irving at the Lyceum, as Ophelia to his Hamlet. Her most notable roles were Portia in *The Merchant of Venice* (1879), Juliet in *Romeo and Juliet* (1882), Viola in *Twelfth Night* (1884), Marguerite in *Faust* (1885), Mistress Page in *The Merry Wives of Windsor* (1902), Alice Grey in Barrie's *Alice Sit-by-the-Fire* (1905), Lady Cecily Waynflete in Shaw's *Captain Brassbound's Conversion* (1906), and Hermione in *A Winter's Tale* (1906). Her first visit to the United States as an actress was made with Irving in 1883, when she won a welcome that was repeated on eight subsequent occasions. Her last regular stage appearance was made in June, 1919, when she played the nurse in *Romeo and Juliet* at the Lyric Theatre in London. In 1925 King George of England conferred on Ellen Terry the high distinction of Dame Grand Cross of the Most Excellent Order of the British Empire. In 1913 she wrote *The Russian Ballet*. See TERRY, FRED; TERRY, PHYLLIS NEILSON; CRAIG, EDWARD GORDON.

**TERRY, FRED** (1863-1933), English actor-manager, brother of Ellen Terry. He was born in London, and married Julia Neilson

(q.v.). His first stage appearance was at the Haymarket in 1880. During his career he played in all the principal cities of the United Kingdom, the United States, and Canada. For many years he was in the companies of noted actors. In 1900, with his wife, he assumed the management of the Haymarket, and in 1915 of the Strand.

**TERRY, PHYLLIS NEILSON** (1892- ), English actress, daughter of Julia Neilson and Fred Terry (qq.v.). She was born in London, made her first stage appearance in *Henry of Navarre* (1909), and played Viola in *Twelfth Night* at the Haymarket in 1910. Subsequently she appeared in the leading roles of other Shakespearean plays and in a revival of *London Assurance* (1913). She had great success in New York in 1915 in an all-star revival of *Trilby*, taking the title role, a part in which she subsequently toured in Canada and South Africa. Later roles were Lady Blakeney in *The Scarlet Pimpernel* (1928) and Queen Mary in *The Borderer* (1929).

**TERRYVILLE**, a town of Litchfield Co., Conn., situated near the Poland R., about 8 miles N. of Waterbury. Dairy farming is the chief industry in the surrounding region. Pop. (1950) 5500.

**TERSTEEGEN, GERHARD** (1697-1769). German mystic and hymn writer, born in Mörs. Tersteegen was too poor to study theology; he worked as a ribbon weaver till 1728, after which he devoted himself entirely to religious writing. After his conversion he practiced great self-denial in order to get means to help the poor. Besides his *Letters* (1773-75), he wrote *Geistliches Blumengärtlein* (1729) and *Lebensbeschreibung heiliger Seelen* (1733-53).

**TERTIAN FEVER.** See MALARIA.

**TERTIARY**, a class in the Roman Catholic Church who, without entering into a monastery, practice in ordinary life all the substantial obligations of the scheme of virtue laid down in the Gospel. It reached full development under the organizations founded by St. Francis and St. Dominic.

**TERTIARY PERIOD**, in geology, a division of time including the beginning of the Cenozoic era, immediately following the Cretaceous period of the Mesozoic era (formerly known as the Secondary period), and preceding the Pleistocene epoch of the Quaternary period; see GEOLOGY, SYSTEMATIC. According to an older classification, the Tertiary period is the third of four major geologic time periods; compare QUATERNARY PERIOD. The Tertiary period began about 60

million years ago and ended about 1 million years ago. The Tertiary period is now generally divided into four major epochs: Eocene, Oligocene, Miocene, and Pliocene. For information on the physiographic changes, flora, and fauna of the Tertiary period, see separate articles on the epochs mentioned above.

**TERTULLIAN**, or (Lat.) QUINTUS SEPTIMIUS FLORENS TERTULLIANUS (about 160 about 210 A.D.), Latin ecclesiastical writer born in Carthage, one of the greatest of the Latin Church fathers, and the creator of Christian-Latin literature. He was trained for the profession of law, practiced in Rome, and became a convert to Christianity about 190 A.D. After his conversion he returned to Carthage, where he was made presbyter and spent the rest of his life. About 203 A.D. Tertullian became a member of the heretical Montanistic sect, which by his day had lost some of its original unorthodoxy but was violently opposed to secularism in the Church. About 207 A.D. he abandoned orthodox Christianity and was thenceforth unsparingly severe in his views of ecclesiastical discipline and in his judgment upon the alleged moral laxity of the "psy-chic", as he called the members of the Church. He retained, however, the deepest respect for the authorities upon which the Church was founded, his only quarrel being with the development of ecclesiastical hierarchy, which he feared would become a political organization. His writings are notable for their blunt manner, keen satire, skillful dialectic, moral strength, and bitter partisanship. As a result of his legal training he expressed his views in a form which imprinted upon Western theology a legalistic character which it has never lost. Tertullian was the first theologian to formulate in Latin the principles on which Catholic orthodoxy came to be based.

Among his many extant writings the best known is the *Apology*, composed probably in 197 A.D. It is a vigorous vindication of the Christians against the attacks and false charges of the heathen world. His polemical zeal was further directed against Jews and heretics, as in his *To the Nations*, *Against the Jews*, *Against Marcion*, *Against the Valentinians*, and *Against Praxas*. He wrote many tracts on subjects connected with morals and Church discipline, including *On Baptism*, *On Penance*, *On Prayer*, *On Patience*, *On Idolatry*, and *On Shows*. His characteristic strictness appears even more strikingly in the works written after he be-

came a Montanist; these include, in addition to many of the polemical works already mentioned, *On Women's Apparel*, *On the Veiling of Virgins*, *On Monogamy*, *On the Exhortation to Chastity*, and *On Fasting*.

**TERUEL**, capital of the province of the same name, Spain. The city lies at the confluence of the Guadalaviar and Alfambra rivers, about 72 miles n.w. of Valencia. It is a commercial center, served by the Sagunto-Calatayud railway line. Among the noteworthy points of interest in Teruel are the 16th-century cathedral, an aqueduct completed in 1560, and the old quarter, a section retaining many medieval features. Teruel was the scene of considerable fighting during the Spanish civil war (1936-39). Early in the winter of 1937-38, a Loyalist army stormed and captured the city, but it was subsequently recaptured by the insurgents.

The province of Teruel is situated in n.e. Spain. Several mountain ranges traverse the province. Javalambre (6568 ft.) is the highest summit. The chief river is the Tagus (q.v.). Besides the Guadalaviar, other important rivers are the Jiloca and the Jalón. The economy of the province is predominantly agrarian. Livestock raising is a leading industry, and the major crops include corn, olives, fruits, wine grapes, hemp, and flax. The province contains a variety of mineral deposits, notably iron, coal, sulfur, and lead. Area, 5721 sq.m.; pop. (1950 prelim.) 236,002. Pop. of city, about 14,000.

**TERVUEREN**, commune of Brabant Province, Belgium, situated about 11 miles E. of Brussels. Points of interest include a royal park and the Belgian Congo Museum. Pop., about 6300.

**TERZA RIMA**, an Italian verse form, of which the first and most notable use was made by Dante in the *Divina Commedia*. Each stanza consists of three hendecasyllabic lines with two rhymes; lines 1 and 3 repeat the middle rhyme of the preceding stanza, and thus the stanzas are closely interwoven. The series or canto necessarily begins and ends with an alternating couplet: aba, bcb, cdc . . . yzyz. The end of a stanza tends to coincide with a pause in the thought. See RHYME.

**TESCHEN**, former capital of a Silesian duchy of the same name. The duchy was formerly an Austrian possession; in July, 1920, after World War I, the Allied Conference of Ambassadors in Paris induced the countries of Poland and Czechoslovakia,

which had conflicting claims to the area, to partition the duchy, including its capital. The duchy is now divided between Poland and Czechoslovakia. The Polish town is now called Cieszyn (q.v.), and the Czech town is called Těšín Český (pop., about 11,000). The towns are situated on the Olsa R., which divides them, and are about 63 miles s.w. of Cracow (Kraków), Poland. The manufactures of the communities include alcoholic beverages, furniture, and linen.

**TESHU LAMA**. See LAMAISM; LHASA. TIBET.

**TESLA**, NIKOLA (1857-1943), American inventor and electrician, born in Smitjan, Lika, Austria-Hungary. He worked in the telegraphic engineering department of the Austrian government until 1881, when he became engineer to an electric company in Budapest. In 1884 he came to America, where he was naturalized and at first was employed in the Edison plant in Orange, N.J. Subsequently working in Pittsburgh and elsewhere, he devoted himself to experimental research and invention. He discovered the principle of the rotary magnetic field, applying it in a practical form to the induction motor. Tesla's discovery made possible the alternating current motor and the transmission of power by such current, employing what became known as 2-phase, 3-phase, multiphase or poly-phase systems, particularly on long-distance lines, later used extensively. Tesla invented many electrical appliances, including dynamos, transformers, induction coils, oscillators, and arc and incandescent lamps, and is principally known for his researches in alternating currents of high frequency and high potential. Tesla later work dealt with the application of such currents to wireless telegraphy, the transmission of power without wires, and many similar problems.

**TESSIN**, COUNT CARL GUSTAF (1695-1770), Swedish statesman, born in Stockholm, son of Count Nicodemus Tessin (q.v.). At the age of thirty he was ambassador to Vienna. Appointed prime minister in 1738, he became spokesman for the "Hat" party. In 1739-42 he was ambassador in Paris. Under King Adolff Fredrik, Tessin exerted much influence as premier, but because he opposed the extension of the king's power he had to resign from office (1752). Tessin was the foremost representative of French culture in Sweden, and one of the most brilliant personages of his time. His literary style was excellent and he was a fine orator. He wrote a daybook of twenty-nine volumes,

and *En Gammal Mäns Bref till ex Ung Prins* (Stockholm, 1753).

**TESSIN, NICODEMUS** (1615–81), Swedish architect, born in Stralsund. In 1646 he became royal architect and in 1674 he was knighted. Among the buildings he erected, many of which are still standing, are Skokloster, Ekolsund, Strömsholm, Drottningholm (completed by his son, see below), and Borgholm castles; Kalmar Cathedral, his principal work of the sort; and in Stockholm, St. Mary's Church, the Wrangel Palace, and Axel Oxenstierna Palace.

**TESSIN, COUNT NICODEMUS** (1654–1728), Swedish architect and statesman, born in Nyköping, son of Nicodemus Tessin (q.v.), and educated at Stockholm and Upsala universities, then trained as an architect under his father and in Italy under the Italian architects Giovanni Lorenzo Bernini and Domenico Fontana. He became royal architect in 1676. His most notable work, the present Royal Castle in Stockholm, begun in 1697 to replace the palace burned that year, was completed after his death. Tessin finished Drottningholm Castle and built the Auditorium Gustavianum at Upsala; Steninge Castle, his home; and various churches. Several foreign monarchs employed him and he held various honorary offices.

**TESTA**, the special protective coat of seeds, which is usually hard, but sometimes (as in certain gymnosperms) develops also a fleshy layer.

**TEST ACTS**, in English history, a series of Parliamentary enactments, passed after the Reformation (q.v.), and requiring public officials to qualify for office by passing a religious test. The most notable of these enactments was that adopted in 1672, and designed to disqualify Roman Catholics from holding office. Among other provisions, the test act of 1672 required civil and military officers to take an oath of allegiance to the king, and an oath, called the oath of supremacy, acknowledging the supremacy of the sovereign in ecclesiastical, as well as temporal, affairs (see SUPREMACY, ROYAL); to renounce the dogma of transubstantiation (see MASS); and to receive communion in accordance with the rite of the established church of England. In 1678 the provisions of the act of 1672 were extended to the peers of the realm, who comprised the House of Lords, and to the members of the House of Commons. In their essential provisions, the later test acts were identical with the enactment of 1672. A test act intended to dis-

qualify Protestant nonconformists was enacted against Presbyterians in 1681; ten years later Parliament enacted another test act intended to perpetuate Protestant supremacy in Ireland.

After 1689 the provisions of the test acts were nullified in the case of Protestant dissenters as a result of the enactment of various laws, including measures legalizing the acts of magistrates who did not conform to the provisions of the test acts. In later years the test acts were modified by amendatory legislation in the case of Catholics and were repealed in 1828; see CATHOLIC EMANCIPATION ACT. Deep-rooted traditions of religious liberty led the Founding Fathers of the United States to prohibit the establishment of religious qualifications for public office. Article VI of the U.S. Constitution provides that "no religious test shall ever be required as a qualification to any office or public trust under the United States". The State constitutions contain similar provisions.

**TESTAMENT**. See BIBL.; WILL.

**TESTER**, a flat canopy over a bed, a pulpit, or a tomb.

**TESTIMONY**. See EVIDENCE.

**TESTING MACHINE**, a machine employed for testing and determining the strength of materials used in construction and engineering works. In order to determine the strength of a given material such as the iron or steel used in a boiler or engine, the wood of a building, or brick, stone or cement, it is usual to select small samples and submit them to stresses of varying degrees, from which, by comparison with standard material, the characteristics of the material may be learned and the relative numerical values obtained.

**TESTIS**. See REPRODUCTIVE SYSTEM.

**TESTOSTERONE**, crystalline male sex hormone,  $C_{19}H_{28}O_2$ , normally present in the tissue of mammalian testes. It melts at  $154^\circ\text{C}$ . ( $309^\circ\text{F}$ .), and is insoluble in water but soluble in alcohol and other organic solvents. Testosterone was originally extracted from testes, but in 1934 Leopold Ruzicka and Adolph Butenandt (qq.v.) developed a method of breaking down sterols which enabled them to synthesize testosterone from cholesterol. The method made a series of testosterone compounds easily accessible, so the hormone is now available as pure testosterone, testosterone propionate, and methyl testosterone.

Human males suffering from testosterone deficiency do not have well-developed mas-



culine characteristics. They have little or no sexual desire, scanty development of body hair, and fat layers distributed much as in females. Administration of testosterone compounds is becoming increasingly successful in remedying these defects, and in alleviating prostatic enlargement in older males. Testosterone does not increase virility in normal males; on the contrary, administration of testosterone to normal males causes a decrease in sexual desire and may lead to impotency. See HORMONE.

**TESTUDO** (Lat., "tortoise"), a Roman military formation used for purposes of assault. The attackers advanced in close order, holding their shields above their heads, with the edges overlapping. The formation resembled the shell of a tortoise, and was an effective protection against weapons of the defenders. In later times the *testudo* was a military engine built to undermine defensive fortifications. It was mounted on wheels and consisted of a frame with a wooden roof covered with clay or hides to make it fireproof again flaming arrows fired from walls by defenders on a besieged city.

**TETANUS**, or LOCKJAW, one of the most formidable diseases of the nervous system, characterized by an involuntary, persistent, intense, and painful contraction or cramp (see SPASM) of more or less extensive groups of the voluntary muscles, nearly the whole of the body being sometimes affected. The muscles of the neck, jaws, and throat are almost always the first to give evidence of the presence of the disease. The neck feels stiff, the jaws are opened with difficulty, and often become tightly clenched, and the face has a peculiar fixed smile (*risus sardonius*). The disease spreads to the muscles of the trunk and the larger muscles of the limbs, with imminent danger of death.

The disease is dependent on a bacillus, *Clostridium tetani*, discovered by Nicolaier in 1884, and cultivated by Kitasato in 1889. The bacillus is a slender rod, with one rounded end containing a spore, and exists in the feces of the herbivora and man, and under favorable conditions the spores remain virulent for years. It is found especially in well-manured soil and in dust and surface soil. This accounts for the fact that wounds infected by dust are often followed by tetanus. The organism often enters the tissues through wounds so slight as to be overlooked.

The preventive treatment of tetanus is most important. Wounds likely to be contaminated with earth should be opened freely,

disinfected thoroughly, and well drained, and a dose of antitetanic serum administered. When these precautions have not been taken and lockjaw sets in, the serum should be promptly injected either into the muscles or spinal canal. No wound is too small to be neglected, and upon the first suspicion of possible infection, medical aid should be immediately consulted. In Germany, upon a death from this cause, neglect is inferred unless an antitetanic serum has been administered.

**TETE**, town and district of Portuguese East Africa. The town is situated on the S. bank of the Zambezi R., about 260 miles N.N.W. of Beira. It is served by a railroad and by river steamers, and has regular airline service. The district of Tete abounds in mineral deposits, including uranium and asbestos. The town is the trading and administrative center of the district, and also maintains a considerable trade with nearby British African possessions. A fort was established by the Portuguese on the site of the present town about 1632. Until 1942 the district was administered by the privately chartered Companhia de Moçambique. Area of district, about 65,000 sq. m.; pop., about 485,000. Pop. of town, about 3200.

**TETE-DE-PONT**. See BRIDGEHEAD.

**TETHYS**, in Greek mythology, a Titaness (see TITANS), daughter of Uranus, god of heaven, and Gaia, goddess of earth. Tethys was the wife of her brother Oceanus (q.v.) and by him mother of the 3000 Oceanids, or ocean nymphs, and of all the river gods.

**TETON**, a branch of the Rocky Mts. in W. Wyoming, stretching from the Yellowstone National Park into Uinta Co., and culminating in the "Three Tetons", whose highest peak is Grand Teton (13,747 ft.). Another summit farther N. is Mt. Moran (12,800 ft.).

**TETRACHORD**, in music, originally, a lyrelike, four-stringed instrument of ancient Greece. From this instrument was derived a series of four notes, also called a tetrachord, which formed the basis of all Greek music. The four notes of the tetrachord, counting downward from the first, comprise the interval of the so-called perfect fourth. Two such tetrachords constituted a scale. When the lowest tone of a tetrachord was the highest tone of another the tetrachords were said to be *conjunct*. When these tones were one tone apart, the tetrachords were said to be *disjunct*, and the tone between the two tetrachords was called the *diaseutic* (disjunctive) tone. Three types of tetrachord

existed in ancient Greek music, namely, the Dorian, Phrygian, and Lydian, each deriving its name from the region of ancient Greece or Asia Minor in which it originated. From each tetrachord a separate scale was developed, named after the tetrachord basic to it. The Greeks also distinguished between *chromatic* and *enharmonic* tetrachords. The first two intervals of the former are semitones, and the third a minor third; the first two intervals of the latter are quarter tones, and the third a major third. The early Greek modes (see *MODE*) were arranged in descending groups of tetrachords; these were adopted and later transformed by the Christian Church into ascending groups of pentachords (see *PENTACHORD*) and tetrachords. See *RELIGIOUS MUSIC*.

**TETRAGRAMMATON**, a term used to designate the name of Israel's God, consisting of the four letters Y H W H. In the Masoretic text it occurs 6823 times and is written with the vowels of Adonai, Lord (originally, my Lord), or with those of Elohim, God. By these vowels the reader was warned not to pronounce the divine name, but to substitute for it Adonai or Elohim. See *JEHOVAH*.

**TETRAHEDRITE**, or GRAY COPPER, an opaque, brown or black-streaked mineral, consisting of copper sulphantimonite,  $\text{CuSbS}_4$ , and varying amounts of silver, and crystallizing in the hextetrahedral class of the cubic system. It has a hardness ranging from 3 to 4.5, a specific gravity of 4.6 to 5.1, and shines with a brilliant metallic luster. The color ranges from grayish black to black. In many deposits the copper is replaced by various amounts of iron, zinc, silver, lead, and mercury, and the antimony by arsenic or bismuth. The arsenic compound forms a complete series, and is known as *tennantite*, after the English chemist Smithson Tennant (1761-1815). The silver-containing variety is known as *freibergite*. Tetrahedrite is commonly found associated with minerals of copper and silver which were formed and deposited by the action of hot water. It may also occur as small crystals in various dolomite deposits, and is often combined with minerals such as pyrites, sphalerite, galena, and other silver, lead, and copper ores. Principal European deposits are found in Cornwall, England, in the Harz Mountains of Germany, and in Transylvania, Romania. In the United States it is excavated in various silver and copper mines of Colorado, Montana, Arizona, Nevada, and Utah, and, in the remainder of the Western Hemisphere, in

Mexico, Peru, and Bolivia. It is used chiefly as an ore of silver (q.v.). See separate articles on most of the minerals named.

**TETRAHEDRON**, a solid bounded by four planes. It appears in nature, and as a crystal is classified as a secondary form of the octahedron, produced by removing the alternate angles or edges of the latter.

**TETRARCH**, a title originally designating the governor of one of four divisions of a country. In the usage of the later Roman Empire the title was given to all minor rulers, especially in the East, possessing sovereign rights, but dependent on the emperor. In Syria the princes of the family of Herod are called indiscriminately either tetrarch or king.

**TETRASTYLE**, a temple or other building having four front columns in its portico.

**TETRAZZINI**, LUISA (1874-1940), Italian coloratura soprano, born in Florence. After only three months' regular study under Cecherini at the Liceo Musicale of Florence she made her debut as Inez in *L'Africaine* (1895), and then sang in Rome and other Italian cities. Her successes in Russia and Spain secured an engagement for Buenos Aires. From there she went through Mexico to California, whence her fame as a second *Puccini* began to spread (1906). In 1908 Oscar Hammerstein engaged her for his Manhattan Opera House in New York. Subsequently she appeared as guest with the Metropolitan, Boston, and Chicago companies. She wrote *My Life of Song* (1921).

**TETUAN**, administrative center and sea port of the Spanish Zone, Morocco, situated on the Mediterranean Sea about 33 miles s. of Tangiers and about 25 miles s. of Ceuta. The city lies in a fertile agricultural district and is linked to Ceuta and points s. by a narrow gauge railway. Among noteworthy points of interest are the Moorish quarter and the old encircling fortifications. The principal exports are leather, fruit, wool, silk, cotton, and livestock. Tetuan was founded in the 16th century by Moors who had been driven from Spain. Pop. (1945) 93,658.

**TETZEL** or **TEZEL**, JOHANN (1465?-1519), German Catholic monk of the Dominican order (see *DOMINICANS*), born in Pöna, Saxony, and educated at the University of Leipzig. A popular and effective preacher, Tetzl was entrusted by the Church with the proclamation of indulgence (see *INDULGENCE*), the most notable of which was in support of the building of St. Peter's Church, at Rome. In opposition to the preaching of Tetzl, the great religious reformer (see *REFORMATION*)

Martin Luther (q.v.) issued his celebrated ninety-five theses, on October 31, 1517. Tetzel responded with a series of 106 countertheses in the following January, and in April set forth a reply to Luther's sermon on indulgences. Despite his vigorous denunciation of the Protestant heresy, however, Tetzel was severely rebuked by the papal legate Karl von Miltz (1490?–1529) for exceptionable language and improper procedure in the presentation of his theses.

**TEUCER**, in Greek legend, the name of two heroes, one Trojan and the other Greek.

**1.** The son of the river god Scamander and the nymph Idæa, and the first king of Troy. He is said to have given his daughter Batea in marriage to Dardanus (q.v.), who succeeded him as king. Teucer is thought to be an eponymous hero invented by the Teucrians, the earliest inhabitants of the Trojan plain and the founders of the city of Troy.

**2.** The son of Telamon (q.v.), King of Salamis, and of Hesione (q.v.), daughter of King Laomedon of Troy. He accompanied his half-brother Ajax (q.v.) to the Trojan War, in which he distinguished himself by his archery. After the war he was banished by his father because he had not avenged the death of Ajax, whereupon he sailed to the island of Cyprus and there founded another Salamis (q.v.).

**TEUFFEL, WILHELM SIGISMUND** (1820–78), German classical scholar, born in Ludwigsburg, Württemberg, and educated at the University of Tübingen. He became professor of classical philology at Tübingen in 1849. His most important work is *die Geschichte der Römischen Literatur* (1869–70), which was translated into English and revised many times.

**TEUTOBURGER WALD**, a mountain range in West Germany, situated in the State of North Rhine-Westphalia, and extending for about 70 m., from near Osnabrück to near Paderborn. Its highest summit is Völsers-tod (1536 ft.). In 9 A.D. the Teutoburger Wald was the scene of a great battle in which Arminius (q.v.), or Hermann, the leader of the Cherusci, destroyed three Roman legions under the general Publius Quinctilius Varus. As a result of the battle Rome lost all possessions E. of the Rhine River, which became the N.E. boundary of the Roman Empire. The exact location of the battle is not known.

**TEUTONES**, a powerful tribe of Germany in ancient times, dwelling originally at the

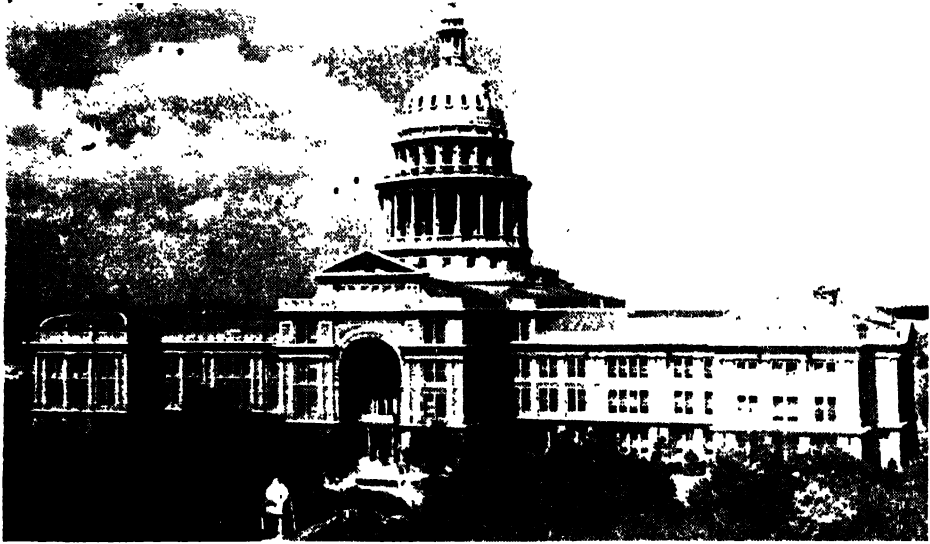
mouth of the Elbe R. About 120 B.C. the Teutones joined the Cimbri (q.v.) in their migration southward, the two peoples invading Gaul and the territory of the Romans. The Teutones remained in Gaul from 104 to 102 B.C., when they were annihilated by the Roman general Gaius Marius (q.v.) at Aqua Sextia (modern Aix-en-Provence). See GERMANIA.

**TEUTONIC KNIGHTS** (The Teutonic Knights of St Mary's Hospital at Jerusalem), an order of knighthood which originated in a brotherhood formed by German knights in 1190 during the siege of Acre by the Crusaders and recognized by Pope Clement III in 1191. In 1198 this association was changed into an order of knighthood as a balance to the political influence of the Templars and Hospitalers. Hermann von Salza, grand master from 1210 to 1239, saw no future in Palestine, and the order engaged in the conquest of the heathen Prussians, inhabiting the Baltic regions to the northeast of Germany. After a fierce struggle of half a century they completed their subjugation in 1283. Christianity was planted with fire and sword, cities were founded, and the land was colonized by Germans. In 1237 the Teutonic Knights absorbed the order of the Brothers of the Sword, and so acquired Livonia and Kurland. They waged long wars with the Lithuanians for the possession of the territory intervening between these regions and the Prussian country. Early in the fourteenth century they extended their dominion westward, making themselves masters of Danzig and Little Poland (Pomerellen). In 1410 the order began to decline. In 1809 it was entirely suppressed by Napoleon in all the German States. It was revived in 1834 as an Austrian order.

**TEUTONIC MYTHOLOGY.** See SCANDINAVIAN MYTHOLOGY.

**TEUTONS**, a group of peoples speaking Teutonic tongues, an important division of the Aryan family of languages. The name is from Latin *Teutones* (q.v.), *Teutoni*; Gothic *thiuda*, a nation. The Teutonic stock is subdivided into the Scandinavian and the Germanic, the latter including Germany and Switzerland, and the Dutch, the Flemings of Belgium, and the descendants of the Angles, Saxons, and Jutes.

**TEWFIK PASHA, MOHAMMED** (1852–92), Khedive of Egypt, the eldest son of Ismail Pasha. He succeeded on his father's abdication in 1879 by virtue of the arrange-



*Texas State Capitol in Austin*

ment of 1866 between Ismail and the sultan. For the events of his reign, see EGYPT.

**TEWKESBURY**, a market town of Gloucestershire, England, on the Avon, 10 miles N.E. of Gloucester. Its Norman church was built in 1123. Within half a mile was fought (May 4, 1471) the battle of Tewkesbury, in which the Yorkists under Edward IV gained a crowning victory over the Lancastrians. Pop. (1951 prelim.) 5292.

**TEWKESBURY**, a town of Middlesex Co., Mass., situated 5 miles S.E. of Lowell. Transportation facilities include a railroad. The town is surrounded by a farming and fruit-growing area, and is a horticultural center. It contains one of the largest plants of the New England Power Company, and is the site of a State hospital and infirmary. The town was first settled in 1637 and was a part of Billerica until 1734, when it was set apart and incorporated under its present name. Pop. (1950) 7505.

**TEXARKANA**, two cities forming a single community situated on the boundary between Arkansas and Texas, 187 miles S.E. of Dallas, Tex., and 147 miles S.W. of Little Rock, Ark. Texarkana, Ark., is the county seat of Miller Co., and Texarkana, Tex., is in Bowie Co. The community is served by five railroads, and maintains a municipal airport. Texarkana is the trading center and shipping point of a wide area in both States,

and an important lumbering and manufacturing center. Among the industrial establishments there are railroad repair shops and yards, lumber mills, planing mills, creosoting plants, cottonseed-oil mills, cotton gins and compresses, and factories producing structural lumber, caskets, furniture, vegetable crates, railroad tank cars, concrete blocks, clay and tile products, toys, paint, mattresses, cotton textiles, processed foods, and pickles. Texarkana is the site of Texarkana Junior College, established in 1927, and of four annual State fairs. Most notable of the various parks in Texarkana is Spring Lake Park, covering more than 170 acres. The Texas-Arkansas boundary passes through the U.S. Courthouse and Post Office Building and the Union Railroad Station. The two cities have separate municipal governments, although in all other respects they are operated as one city. Texarkana was settled in 1874. Pop. (1950) of Texarkana, Ark., 15,875, and of Texarkana, Tex., 24,753.

**TEXAS**, one of the West South Central States of the United States, bounded on the N. by New Mexico, Oklahoma, and Arkansas, on the E. by Oklahoma, Arkansas, Louisiana, and the Gulf of Mexico, on the S. by the Gulf and Mexico, and on the W. by Mexico and New Mexico. Texas ranks as the 1st State in the Union in area, 6th in order of population (1950), and the 28th in order of admission to



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the Union, having entered on Dec. 29, 1845. The capital is Austin. In descending order of population (1950), the principal cities of the State are Houston, Dallas, San Antonio, Fort Worth, Austin, El Paso, Corpus Christi, Beaumont, Waco, Amarillo, and Lubbock (qq.v.). The area of Texas comprises about one twelfth of the total area of the United States and the State is longer and wider at its extreme points than any other State. The maximum length of the State is about 800 m., and the maximum width is about 770 m. The distance from El Paso, which is situated in the westernmost part of Texas, to Beaumont, which is located near Louisiana and the Gulf of Mexico, is greater than the distance between New York and Chicago. Although the general coastline of Texas

measures only 367 m., the over-all coastline, measured around bays, inlets, and estuaries reached by tidal water, is 2982 m. Area of Texas, 267,339 sq m., including 3695 sq m. of inland water surface. Population (1950) 7,711,194.

Texas possesses an irregular triangular shape with the apex pointed s.; a rectangular, handlelike projection called the "Panhandle" extends northward. In general, the surface rises gradually from e. to w. in a succession of broad and more or less terraced slopes running parallel with the Gulf coast. A number of well-marked topographical regions may be distinguished. The first is the coastal plain, a continuation of the same formation in the other Gulf States (see LOUISIANA; MISSISSIPPI); it rises gradually from sea level

to an altitude of 500 ft. about 150 m. inland, and it is level in its lower portion and somewhat hilly near its inner border. The coast itself is lined almost throughout its length by lagoons cut off from the sea by long, narrow sand islands. The northern lagoons generally extend some distance inland in large, irregular bays and estuaries, lined partly by low, marshy shores, and partly by high bluffs. The principal bays are those of Galveston, Matagordo, San Antonio, and Corpus Christi. The longest island, Padre, is at the s.e. extremity of Texas, and extends for more than 100 m. from the mouth of the Rio Grande to Corpus Christi Bay. Padre Island encloses the largest lagoon along the Texas Gulf coast, the Lagoon de la Madre.

The western portion of the coastal plain is a belt of rolling country known as the Black Prairie, which is about 100 m. wide in the n. and s., but extremely narrow in the middle. It is succeeded on the n.w. by a very broad belt of country, the North Central Plains, called by geologists the central denuded region. It rises from a height of 600 ft. in the e. to over 2000 ft. in the w., and is a rugged and much eroded, though not mountainous, region, possessing ridges, prairie valleys, isolated tablelands, and irregular depressions. The North Central Plains are bounded on the w. and s.w. by the Plateau region, a continuation of the continental Great Plains. South of the Panhandle, the Plateau region forms a large, flat-topped tableland, the Llano Estacado, which, from an elevation of 4000 ft., falls on the e. into the North Central Plains in a high, steep, and ragged escarpment cut back by several large river valleys. On the s.e. the Great Plains run out into a lower plateau of different formations known as the Grand Prairie, which sweeps around the southern end of the central denuded plateau and runs northward between the latter region and the Black Prairie, where its elevation decreases. The southern portion of the Great Plains in Texas is known as Edwards Plateau. The Plateau region of the Great Plains extends southward to the Rio Grande Valley, and is bounded on the s.e. by the Balcones Escarpment.

The last topographical region, the portion of the State lying in the s.w. and called the Trans-Pecos province, is a mountainous country containing a number of high, isolated, and barren ridges alternating with broad and arid plains. The principal divisions of this region are the Stockton and Diablo plateaus, and a number of isolated, block mountain

ranges including the Guadalupe and the Davis mountains. The highest point in the State is Guadalupe Peak (8751 ft. above sea level), situated in Culberson Co., just s. of New Mexico. The lowest point is at sea level along the Gulf of Mexico. The average elevation of Texas is 1700 ft. above sea level.

The principal rivers are the Rio Grande, Red River, and the Canadian, San Antonio, Pecos, Brazos, Sabine, Neches, Trinity, Colorado, Guadalupe, and Nueces (qq.v.). Almost all the rivers flow southeastward. With the exception of the Canadian R. in the n., and the Rio Grande and Pecos in the s., which rise in the Rocky Mountains, all the larger rivers rise on the e. edge of the Great Plains, the Llano Estacado, and the Grand Prairie. The extreme northern portion of Texas is part of the Mississippi Basin. The Canadian R. flows eastward across the Panhandle to join the Arkansas R., while the Red R., which rises on the escarpment of the Llano Estacado, forms a portion of the State's northern boundary as it flows e. and then s.e. to the Mississippi R. The independent rivers flow directly to the Gulf of Mexico, and all, except the Brazos and the Rio Grande, empty through estuaries into the coast lagoons. The Sabine R. flows s.e. to the Louisiana boundary, and then s., forming the border, to the Gulf. The Rio Grande, flowing southeastward, separates Texas from Mexico. Several of the rivers are navigable for considerable distances at high water, but their mouths are generally obstructed by bars.

Texas reaches within two and a half degrees of the tropical zone, but the great range in latitude, and to some extent in altitude, produces a considerable range in climatic conditions. Although warm, the climate is drier than that of the other Gulf States. The mean annual temperature in the Panhandle is 55°F, and that in the southernmost part of Texas is 72°F. On the coast the temperature seldom falls below the freezing point, while in the n. and n.w. it may fall several degrees below zero. In the winter the State is subject to severe winds, known as northers, which often lower the temperature as much as 50 degrees in a few hours. In the fall, the Gulf coast portion of the State is subject to tropical hurricanes. Rainfall is abundant in the s.e., but the amount decreases toward the w. Galveston receives an average of 46 inches a year and El Paso receives an average of 9 inches a year. There is little or no snowfall along the lower Rio Grande and the coast, but parts of the Pan-



Dallas Chamber of Commerce

*Above Skyline view of downtown Dallas, Texas Three tallest of buildings seen are, from left to right Medical Arts Hospital, Mercantile National Bank Building, and Magnolia Building Right The Alamo, famous historical landmark in San Antonio, Texas*

handle receive as much as 19 inches a year. The average snowfall for the State as a whole is 5 inches a year.

The fauna of Texas includes deer, coyotes, prairie dogs, jack rabbits, bears, mountain lions, raccoons, skunks, opossums, muskrats, foxes, minks, game birds, alligators, snakes, and toads. Among the trees in the State are the pine, ash, magnolia, oak, gum, hickory, and cypress. Well over 10,000,000 acres of forest land are in Texas, and there are numerous State parks and the Big Bend National Park (qv).

Texas is the ranking State of the U.S. in the production of minerals; it is first in petroleum, helium, natural gas, and sulfur. In a recent year Texas produced more than 829,280,000 barrels of petroleum (about 42% of the total production in the U.S.), 3,519,173,000,000 cu ft. of natural gas, 3,678,000 tons of sulfur (about 76% of the total U.S. production), and over 55,000,000 cu ft. of helium (Texas is the only source of the gas in the U.S.). Other mineral products of the State include natural gasoline, liquefied petroleum gases, salt, lignite, gypsum, asphalt, sandstone, granite, mercury, potash, limestone, coal, silver, copper, lead, graphite, zinc, gold, manganese, and marble.



Although less than 20% of the total area of Texas is under cultivation, the State ranks second in the U.S. (after California) in value of its crops. Texas leads the nation in the production of cotton, pecans, and grain sorghum. In a recent year about 4,074,000 bales of cotton, 33,000,000 pounds of pecans, and 42,143,000 bushels of grain sorghum were produced. Approximately 120 crops are cultivated, cotton, which represents nearly 50%



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*Crossing the toll bridge between Mexico and El Paso, Texas*

of the total value of crops produced is the most important. Other crops include winter wheat, onions, corn, rice, oats, potatoes, sweet potatoes, peanuts, oranges, peaches, grapefruit, vegetables, barley, rye, apples, cantaloupes, figs, dates, blackberries and strawberries. In a recent year there were about 331,500 farms, covering more than 145,389,000 acres and valued at (land and buildings) approximately \$6,718,000,000, the cash income from crops exceeded \$1,267,000,000, and the cash income from the sale of livestock was approximately \$879,700,000. Texas leads all States in cattle, which recently numbered over 8,940,000 (including 1,053,000 milch cows). In addition, there were about 6,176,000 sheep, 96,000 mules, 549,000 turkeys, 22,992,000 chickens, 2,099,000 goats, 321,000 horses, and 1,645,000 hogs. Texas also leads the nation in wool and mohair production. In a recent year the wool clip from 6,555,000 sheep totaled about 51,569,000 pounds, and the mohair clip from 2,675,000 goats was 13,900,000 pounds.

Texas is the foremost manufacturing State of the Southwest. In a recent year over 7100 manufacturing establishments employed almost 329,000 persons, value added by manufacture totaled more than \$2,268,000,000. Only seven States possess more manufacturing

plants than Texas. The State's manufacturing industries are almost completely based upon the local agricultural and mining industries. Petroleum refining accounts for approximately 40% of the total value of the manufacturing output. Slaughtering and meat packing, the manufacture of cottonseed oil cake and meal, flour and grist milling, and the manufacture of foundry and machine shop products, leather goods and lumber and wood products are other important industries. Fishing is also important; shrimp, oysters and red snappers are caught.

Transportation includes more than 15,000 m. of main track railway and approximately 47,000 m. of State highways in addition to Federal and county highways and roads. Over 640 airports are in the State, of which more than 165 are commercial, more than 150 municipal, and 100 equipped for night flying. Eleven commercial air lines operate in the State.

Attendance at the elementary and secondary schools of Texas is free and compulsory during 100 days of the school year for all students between the ages of seven and sixteen. In a recent year more than 2800 public elementary and secondary schools were attended by more than 1,307,000 students and were staffed by more than 49,000 teachers.





Tex Highway Dept Stand Oil

SCENES IN TEXAS Above Lonely stretch of highway crossing a vast plain Right Highway at a small town Below View from the shore of Galveston Bay



Segregation of white and Negro children is practiced. There are 95 institutions of higher learning, of which 21 are maintained by the State. The University of Texas (see TEXAS, UNIVERSITY OF) at Austin is the largest of the State-supported schools. Other institutions of higher learning include Baylor University at Waco, Texas Christian University at Fort Worth, Southern Methodist University at Dallas, Rice Institute at Houston, Hardin-Simmons University at Abilene, Texas Technological College at Lubbock, Texas Agricultural and Mechanical College at College Station, Howard Payne College at Brownwood, Southwestern University at Georgetown, Incarnate Word College at San Antonio, Trinity University at San Antonio, and Texas Wesleyan at Fort Worth.

Texas is governed according to the terms of the constitution of 1876, as amended. Executive authority is vested in a governor, lieutenant governor, comptroller of public accounts, treasurer, superintendent of public education, attorney general, and commissioner of agriculture, all of whom are elected for two-year terms; three railroad commissioners, who are elected for six-year terms; and a secretary of state, who is appointed by the governor. Legislative authority is vested in a senate consisting of 31 members, of whom half are elected for four-year terms every two years, and a house of representatives consisting of 150 members, all elected for two-year terms. Judicial authority is vested in a supreme court, 11 civil appellate courts, and a court of criminal appeals, all consisting of 3 justices apiece elected for six-year terms; more than 100 district courts; county courts; and justices of the peace. Electors are all U.S. citizens who have reached the age of twenty-one, resided in the State at least one year, the county at least six months, and have paid a poll tax prior to Feb. 1 of the year in which they wish to vote. Texas is divided into 254 counties, and is represented in the Congress of the U.S. by 2 senators and 22 representatives.

*History.* The first European to penetrate the region which is now Texas was Cabeza de Vaca (see CABEZA DE VACA, ÁLVAR NÚÑEZ) in 1528. In 1540 Francisco Vázquez de Coronado (q.v.) explored the region. During the following century numerous other Spanish expeditions crossed the territory and in 1682 the first settlement in Texas was founded at Isleta, near El Paso. In 1685 Robert Cavalier, Sieur de La Salle, established a French colony at Matagorda Bay. Although the French

colony soon ended in failure, the settlement being abandoned, the Spanish took steps to strengthen their claim to Texas against possible future encroachments by the neighboring French in Louisiana. From 1690, the Spanish established numerous missions, towns, and military posts in Texas. The region, which the Spanish had named after the Texas Indians, an intertribal confederacy of Caddo Indians, underwent its first American invasion in 1799 when a small party of Americans, led by a trader named Philip Nolan, penetrated the region ostensibly to capture wild horses. Two years later, on a second expedition, the adventurers were attacked by the Spanish, who killed some and imprisoned the survivors.

After the purchase of Louisiana (see LOUISIANA PURCHASE) in 1803, the people of the U.S., particularly the inhabitants of the Southwest, considered Texas a part of the destined dominion of the Republic and never lost an opportunity to strike at the Spanish power. An American invasion occurred in 1812 when Augustus Magee, a former U.S. Army officer, and Bernardo Gutiérrez, a Mexican patriot who was fighting for the independence of Mexico from Spain, led an expedition into Texas, captured San Antonio, and defeated several Spanish Mexican forces before they themselves met defeat (see MEXICO History). In 1819 and 1821 James Long, a Mississippian, led expeditions into Texas for the purpose of making the region an independent state, but he also met with defeat. In the latter year Moses Austin, an American, secured from the Spanish government the right to establish a colony in Texas. He died soon after, but his son Stephen (see AUSTIN, STEPHEN FULLER) took up his work. In this period Mexico succeeded in securing its independence from Spain, and in 1823 Austin concluded a new agreement confirming his father's grant. The new Mexican government then authorized empresarios, or agents, to attract American settlers to Texas. Austin was the most successful of the empresarios, and the system was responsible for the rapid growth of the American colonies in Texas. In a few years American grants covered the region between the Sabine and Nueces rivers.

In 1826 the Fredonian Rebellion occurred; a band of Americans, led by Hayden Edwards, proclaimed the eastern part of the territory the independent Republic of Fredonia. A skirmish in which one man was killed and one wounded ended the uprising. In 1830 the Mexican government passed a



*Herding cattle on a grazing range in Texas*

decree, severely limiting American immigration to Texas. Other decrees, many of which were designed to curtail the expansion of the American settlers, were passed by the government, and in 1835 war broke out between the American settlers and the Mexican government. The first battle of the Texas Revolution, fought at Gonzales on Oct. 2, 1835, was won by the Texans. San Antonio was captured by the Texans in the same year, a provisional government was set up, and Samuel Houston (q.v.) was named commander in chief of the Texan armies. Many Americans from the States hastened to the assistance of the Texans. In February-March of 1836 occurred the heroic defense of the Alamo (q.v.) by about 180 Americans commanded by Col. W.B. Travis and Col. David Crockett. The massacre of Goliad (q.v.), in which all the Texans captured in a previous battle by the Mexicans were ordered slain by Antonio López de Santa Anna (q.v.), president and commander of the Mexicans, also occurred in March. On March 2, 1836, the Texans issued a declaration of independence. On April 21, at San Jacinto (see SAN JACINTO, BATTLE OF), the Texan army under Houston inflicted a disastrous defeat upon the numerically superior Mexican army, and cap-

tured its commander, Santa Anna. The victory insured the independence of Texas. In September, 1836, Sam Houston was elected president of the Republic of Texas.

Indian wars, raids by Mexican forces, and financial difficulties beset the young republic, which had been quickly recognized by the United States, France, Great Britain, Holland, and Belgium. The question of the annexation of Texas to the Union became a national issue and James Knox Polk (q.v.) was elected President of the U.S. on a platform favoring the admission of Texas, but before he took office Congress passed a joint resolution offering Statehood to the republic. This offer was quickly accepted and on Dec. 29, 1845, Texas was admitted to the Union. The Mexican War (q.v.), originating in a dispute over the boundaries of Texas, followed, and the first fighting took place near the Rio Grande at Palo Alto on May 8, 1846. In 1848, by the Treaty of Guadalupe Hidalgo, ending the war, the Rio Grande was recognized by Mexico as the southern boundary of Texas. At this time, Texas included, in addition to its present area, present-day Colorado, the eastern half of New Mexico, s.w. Kansas, and portions of Wyoming and Oklahoma. Texas and the U.S. agreed to the Compromise



Standard Oil Co (N J)

*Working with pipes at a derrick in a Texas oil field*

of 1850, in which for the payment to Texas of \$10,000,000 the US received all the territory claimed by Texas except that area which now comprises the State (see COMPROMISE MEASURES OF 1850)

Texas grew rapidly after its entrance into the Union. As a Southern, slave-holding State, it seceded from the Union on Feb 1, 1861. Little fighting occurred in Texas during the Civil War. Galveston was occupied by Federal forces for a short time, and the last battle of the war, which took place one month after General Robert E. Lee's surrender at Appomattox on April 9, 1865, was fought on the lower Rio Grande on Texas soil. The Reconstruction (q.v.) period proved difficult for Texas, but the State recovered

rapidly as it expanded its agricultural and manufacturing industries. The discovery of the first great oil field in the State at the beginning of the 20th century greatly spurred the industrialization process.

The events attending the Civil War and the Reconstruction period engendered powerful anti-Republican traditions in Texas, and the voters of the State have almost invariably voted for Democratic Party candidates in State and national elections since its readmission to the Union. Between 1876 and 1952 Texans have cast a majority or plurality of their ballots for the Democratic candidate in every Presidential election year except 1928 and 1952. In the election of 1928 Herbert Hoover, the Republican candidate, carried the

State over Alfred E. Smith, the Democratic candidate by 367,036 votes to 341,032 votes. In 1952 the Republican candidate Dwight D. Eisenhower received 1,102,878 votes; the Democratic candidate Adlai E. Stevenson received 970,128 votes.

**TEXAS AGRICULTURAL AND MECHANICAL COLLEGE**, a State controlled land-grant college for men, located at College Station, Brazos Co., Tex., and founded in 1871. Courses in agriculture, engineering, and architecture are offered leading to bachelors' and doctors' degrees. A four year course in veterinary medicine leads to the degree of D.V.M. The United States Department of Agriculture operates a number of experiment stations and an extensive branch of its forestry service in connection with the curricula of the college. Since 1947-48 the department of agriculture has included a five year course in food technology. The department of aeronautical engineering trains pilots for examinations granting private or commercial licenses and flight instructor ratings. In a recent year over 6500 students were enrolled at the College, and the faculty numbered about 525.

**TEXAS CHRISTIAN UNIVERSITY**, a co-educational institution of higher education, controlled by the Disciples of Christ Church in Texas, and located at Fort Worth, Tex. It was chartered as a private school in 1873 under the name of the Add Ran Christian University, and became the property of the Christian Church of Texas in 1890; the present name was adopted in 1902. Courses are offered in the liberal and fine arts, education, business, music, oratory, and law, leading to bachelors' and masters' degrees. A School of the Bible confers the degree of bachelor of divinity. Special programs of study in engineering, home economics, journalism, and nursing are included in the curricula. In a recent year more than 6000 students were enrolled in the University, and the faculty numbered about 214.

**TEXAS CITY**, a city of Galveston Co., Tex., situated on Galveston Bay, opposite the city of Galveston and about 40 miles S.W. of Houston. Transportation facilities include two railroads. Texas City is a leading seaport ranking 11th in the U.S. in tonnage of cargo handled. It has a fine, deep-water harbor, and is an important shipping point for cotton, oil, and sulfur. In a recent year, over 8,000,000 tons of cargo passed through the port. Among the industrial establishments in the city are oil refineries, chemical plants, the

largest tin smelter and processing plant in the world, and factories manufacturing cotton bagging. On April 16, 1947, an explosion occurred in the harbor aboard a French cargo ship carrying explosive chemicals; the explosion caused fires in adjacent chemical plants and oil refineries in the city. Next day occurred a similar explosion on an American freighter carrying similar cargo. As the result of both disasters, considered the worst in U.S. shipping, 592 persons were killed and missing in Texas City and 800 injured. Extensive areas of the city were destroyed by fire, the property damage being estimated at \$50 million, but rebuilding commenced almost immediately. Pop. (1950) 16,620.

**TEXAS FEVER**, also known as **BOVINE PIROPLASMOSIS**, **BAHUSIASIS**, **SPLENETIC FEVER**, **TICK FEVER**, **SOUTHERN CATTLE FEVER**, **HEMOGLOBINURIA**, **REDWATER**, **DRY MURRAIN**, **BLACKWATER**, or **SPANISH FEVER**, a febrile infectious disease of cattle, usually observed in epizootic extension in the course of which hemoglobin appears in the urine as a result of the breaking down of red blood corpuscles. It is caused by (*Piroplasma*) *Babesia bigemina* in the red blood corpuscles. This protozoan is transmitted to uninfected cattle by the progeny of ticks, particularly of the genus *Margaropus* or *Boophilus*, that have developed on infected animals. The disease is characterized by fever, greatly enlarged spleen, destruction of the red blood corpuscles, escape of the coloring matter of the blood through the kidneys, giving the urine a deep-red color, yellowness of the mucous membranes and fat, rapid loss of strength and fatal results in a large proportion of cases.

**TEXAS LONGHORN CATTLE**, or **TEXAS STEERS**, a type of hardy and scrawny range cattle descended from the early Spanish cattle first introduced into Mexico. These were narrow-backed, flat-ribbed, leggy cattle, with heavy heads and usually with wide-spreading horns. They were slow and hard feeders, useful only under the severe conditions of pioneer range life. Great herds of Longhorns were driven annually by cowpunchers from Colorado, Wyoming, and Montana down to Kansas and Texas for feeding. With the introduction of better breeds such as the Hereford and Shorthorns, the Texas Longhorns have almost vanished from the plains.

**TEXAS TECHNOLOGICAL COLLEGE**, a coeducational, State-controlled institution of higher education, located at Lubbock, Tex.,

and opened in 1925. Courses are offered in agriculture, home economics, and engineering (including petroleum and textile engineering) leading to bachelors' and masters' degrees. In a recent year the enrollment was over 4900, and the faculty numbered about 300.

**TEXAS, UNIVERSITY OF**, a coeducational, State-controlled institution of higher education, with its main campus at Austin, Tex., and schools of medicine, pharmacy, and nursing at Galveston, of dentistry at Houston, and the College of Mines and Metallurgy at El Paso, Tex. The University was organized in 1881 with a grant of over 2,000,000 acres of land from the State. This land subsequently proved to be enormously rich in oil, gas, and minerals; accumulated revenue from its holdings provided the University with the unusually large endowment of nearly \$75,000,000 in a recent year. The departments of arts and sciences, law, engineering, education, and a bureau of economic geology and technology are located at Austin. Courses are offered in all schools leading to undergraduate and graduate degrees. The department of education, as a part of its teacher-training program, conducts extensive experimental work in the study of child development, speech, psychology, counseling, and guidance. In a recent year student enrollment was about 12,500, the faculty comprised about 748 members, and the library included nearly 1,000,000 volumes.

**TEXEL**, an island belonging to the province of North Holland, at the entrance to the Zuider Zee. It is separated from the mainland by a narrow strait, called the Marsdiep, and it contains about 35,000 acres of arable and pasture lands. The Marsdiep channel or part of it is often called the Texel, and in it many important naval battles have been fought. Blake defeated Van Tromp and De Ruyter in 1653; Prince Rupert fought De Ruyter in 1673; and Duncan blockaded the Texel in 1797.

**TEXTILE PRINTING.** Block printing of textiles in one form or another can be traced back among the Egyptians, Assyrians, and Chinese to remote ages, and it was closely associated with other similar processes that produce similar results, such as painting, stenciling, and dyeing. In printing fabrics the color is stamped on from an engraved block or roller. Pliny says that the Egyptians figured fabrics by applying several mordants with different powers of resistance, presum-

ably by stamping or stenciling, in such a way that one dipping in the dye pot produced a pattern in several colors. During the twelfth, thirteenth, and fourteenth centuries, in Germany, the place of the rich Saracenic, Byzantine, and Italian damasks and brocades was largely taken by inexpensive block-printed imitations. There survive examples of Rhenish thin-printed silks with simplified patterns in gold and silver; and coarse linens outlined in dark browns and blacks. In the seventeenth century the industry revived and Augsburg was famous for its printed linens, supplying Alsace and Switzerland with many trained workmen. In 1676 textile printing was introduced into England by a French refugee who opened an establishment on the Thames near Richmond. In the last half of the eighteenth century the art was brought to a high point of perfection in France, especially at Jouy, near Versailles, where Oberkampf produced printed linens.

At the end of the eighteenth century metal rollers took the place of wooden blocks for the production of simple repeat patterns inexpensively, and the modern machine period had begun. The invention of rollers is attributed in France to Oberkampf and in Great Britain to Bell. In the last quarter of the nineteenth century William Morris raised the standard of design greatly by his introduction of ingenious and richly colored flower and bird patterns, going back for his inspiration to Persian and Indian flat ornament.

*Stenciling* is nearer painting than printing, the colors being applied with a brush through sheets of thick paper or thin metal from which the pattern has been completely cut out with a sharp knife, the uncut portions covering the parts of the surface that are to be left uncolored. A peculiarity of stenciled patterns is the ties that have to be left to keep detached or nearly detached portions of the background connected with the rest of the stencil. These ties spoil the design when badly placed, but when skillfully used add distinctive charm. The Japanese are especially skillful in the use of stencils, often employing them in connection with painting and with block printing.

The printing of woolen and silk cloths is similar to that of cotton, except that the woolen cloth requires more preparation before printing and the silk cloth less; and that silks are particularly adapted to discharge and reserve effects. See *DYEING*.



Metropolitan Museum of Art

TEXTILE PRINTING. Top, left Print on French linen of the 18th century Top, right: Design on German linen of the 19th century. Bottom. English printed cotton, about 1800.

**TEXTILES**, tabris produced by spinning and weaving (qq.v.). See separate articles on the various fabrics, such as cotton, linen, nylon, rayon, silk, and wool.

**TEXTUAL CRITICISM**, the criticism of existing texts of literary works with a view to the detection of variations from the original manuscript. Such criticism may be concerned with any literary production which is no longer under the control of the author, but is most usually applied to the manuscripts of the Old and New Testaments and of the works of ancient Greek and Latin authors, which were changed by the inaccurate work of those who copied them by hand before the invention of printing; and to the texts of such later writers as William Shakespeare, whose works were often changed by the printers who set them in type. Textual criticism involves two distinct processes: *recension*, or the collection and examination of the most trustworthy documentary evidence as a basis for the establishment of the correct text; and *emendation*, or the attempt to eliminate the errors which even the most accurate manuscripts contain, by the deliberate overruling of the documentary evidence and the substitution, by conjecture, of material which is in accord with both transcriptional and intrinsic probability. The results of the latter process are not considered thoroughly reliable unless they are confirmed, as sometimes happens, by the subsequent discovery of new evidence.

The criticism, for example, of the texts of Greek and Latin authors is based primarily upon a careful study and comparison of all existing manuscripts. The secondary consideration is subsidiary evidence, known as *testimonia*, which may be in the form of ancient or medieval references to, or quotations and reminiscences of, the passage under consideration; scholia (see SCHOLIASTS); or translations into another language, such as the Latin and Arabic renderings of certain works of Aristotle. Most classical manuscripts, excluding documents on papyri discovered during the past hundred years (see PAPYRI, DISCOVERIES OF), date from the 9th to the 15th century; a few are as early as the 4th century, and some, generally of little value, as late as the 15th and 16th centuries. No existing manuscript is free from errors. The scribes often did their work mechanically and ignorantly, and the blunders thus made were perpetuated by each succeeding copyist. Such errors may be corrected by comparison with a manuscript which does

not contain the identical blunders, but if all existing manuscripts are descended from the same incorrect original, or archetype, the same errors probably appear in all. In such an event, the only resort is to conjectural emendation. If a number of manuscripts have for the same passage different readings, all of which are intelligible, recension is used to determine which of the several readings is the one intended by the author.

The textual critic must establish the interrelationship of the various texts by systematized comparisons. Generally, identity of reading implies identity of source. Although an early text is presumed to be more valuable, having been less exposed to repeated corruptions, it may be filled with errors, whereas a later manuscript may be a fairly accurate copy of a more reliable text, now lost. A majority of manuscripts need not give the more correct reading; three extant copies of a corrupt text, now lost, have less value in textual criticism than a single good manuscript. In the critical examination of the evidence, all copies of a manuscript still extant may be disregarded, provided that none has drawn material from another source which is no longer in existence.

Certain types of errors were commonly made by scribes in the copying of manuscripts, and may be divided into the following classes: (1) errors of *omission*, known as haplography, involving the leaving out of one of two identical letters, syllables, or words, or the omission of entire clauses or sentences in prose or lines in poetry, such as often occurred when two sentences or lines ended with the same word; (2) errors of *insertion*, known as dittography, involving the repeating of a letter, syllable, or word, or the addition to the text of an explanatory word, gloss, or marginal note, (3) errors of *substitution*, such as the substitution of an explanatory gloss for the word it defined, or of a classical form for an archaic form which the scribe failed to understand; (4) errors of *transposition*, such as the misplacing of letters, syllables, words, or lines, usually ascribed to the inaccurate insertion of material previously omitted by a copyist; (5) errors of *emendation*, occurring chiefly in manuscripts dating from the 9th century or later and especially common in manuscripts written by Renaissance scholars, arising from the wrong division of words, or from attempts to correct mistakes already made of obscure words and phrases



which were deemed corrupt; and (6) errors due to the *confusion of letters and contractions*, occurring seldom in capital and uncial writing (see *PALIOGRAPHY*), but often in minuscule manuscripts, especially with the increasing use of contractions and arbitrary signs.

Frequently the textual critic, in following the process of emendation, finds manuscripts which contain meaningless or metricaly impossible passages, or phrasology in violent contradiction to or deviation from an author's normal usage. In all such instances the passage is pronounced corrupt, in spite of the external evidence in its favor, and emendation is resorted to as a means of restoring the original reading of the text. All such conjectural emendation must be based on expert knowledge of paleography and the principles of textual criticism, and of the style and subject matter of the author and the age in which he lived. Conjectural emendation has been termed "at once the highest and the most difficult part of the textual critic's task."

**TEYTE, MAGGIE.** (1890– ), English lyric soprano, born in Wolverhampton. She made her debut at Monte Carlo in 1908 as Zerlina in Mozart's *Don Giovanni*. For the next two years she was a member of the Opera Comique, where Beecham heard her and engaged her for his first operatic season in London (1910). On coming to the United States, she became a member of the Chicago Opera Company (1910–15) and made extensive concert tours of the States. Her favorite roles were Mimi in *La Bohème* and Melisande in *Pelléas et Mélisande*.

**TEZCATLIPOCA**, one of the chief gods of the Aztecs. The creator of the world, he was represented as a handsome man, endowed with perpetual youth. A captive of fair and unblemished form was occasionally sacrificed to Tezcatlipoca.

**TEZUCUCO**, a city of Mexico, on the E. shore of the lake of the same name, 25 m. by rail ENE of Mexico City. The ancient *Acolhuacan* was once the chief seat of Aztec culture. The lake has an area of 92 sq.m. Pop., about 16,000.

**THAALIBI** (961–1083), Persian writer upon philological and literary subjects, born in Nishapur. He represented the Persian-Arabic school of literature. In Thaali's time philology was passing from the ancient schools of Basra and Kufa to Persian soil. Thaali's great anthology, *Yatimat al Dohr*, is an invaluable source of information con-



Maggie Teyte

cerning Moslem poets, and reveals critical judgment as well as erudition.

**THACKERAY, WILLIAM MAKEPEACE** (1811–63), one of the greatest of English novelists, born in Calcutta, India. In 1829 Thackeray was entered at Trinity College, Cambridge. He left the university after two years without taking his degree.

On leaving Cambridge Thackeray traveled for two years. From the first he had a passion for drawing and literary composition, his fancy in both running to caricature. Early in 1833 he became a contributor to the *National Standard and Weekly Journal of Literature, Science, Music, Theatricals, and the Fine Arts*, a weekly journal. With the nineteenth number Thackeray took the editorship and subsequently became the proprietor. The paper came to an end after a year's existence. However, art, not literature, was Thackeray's ambition and he went to Paris to study painting. After his return to London he made the famous application to illustrate *Pickwick*. By 1837 financial reverses made him become a literary hack. He contributed regularly in the *Times*, and also the *New Monthly*, *Fraser's Magazine*, and in Cruikshank's *Comic Almanacks*. In 1840 his wife, after the birth of the third daughter, became affected in mind, and never recovered, though she lived till 1894. This misfortune broke up the home, and for a time caused much misery to Thackeray. But his genius was by this time asserting itself.



William Makepeace Thackeray

In 1840 appeared his first book, *The Paris Sketchbook*, a series of reprints, followed in 1841 by the *Comic Tales and Sketches*, which contained the *Yellowplush Papers* from *Fraser*, *Major Gahagan* from the *New Monthly*, and the *Bedford Row Conspiracy*. In the same year the *Hoggarty Diamond* and the *Shabby Genteel Story* appeared in *Fraser*, followed by *Barry Lyndon* and *Men's Wives* in the same magazine. In 1843 and 1846 appeared respectively the *Irish Sketchbook* and *Cornhill to Cairo*, and in 1842 he joined the staff of *Punch*. The publication of *Vanity Fair* began, in monthly numbers, early in 1847 and by the time it was finished it had made the author's reputation.

The last number of *Vanity Fair* appeared in July, 1848. It was followed in November of the same year by the first installment of *Pendennis*. *Pendennis* was followed by *Henry Esmond*, published in three volumes in 1852. Thackeray then sailed for America with his lectures on the humorists. On his return in 1853 *The Newcomes* began to appear; and on its conclusion in 1855, after the publication of *The Rose and the Ring*, which was begun in Rome, Thackeray again made a journey to America with his lectures on the "Four Georges". In 1857 the *Virginians* came out.

On January 1, 1860, the *Cornhill Magazine* made its appearance, with Thackeray as editor. To the *Cornhill* he contributed *Lover*

*the Widower* and *Philip*. But if the *Cornhill* did not bring out Thackeray's best work as a novelist, it furnished the occasion for the *Roundabout Papers*. In 1862 he gave up the editorship of the *Cornhill*, not being equal to the task of refusing manuscripts, but he continued to work for the magazine. He now began to write *Denis Duval*. But his health failed. No immediate danger was feared, but he was found dead in his bed on the day before Christmas, 1863.

**THADDÆUS**, one of the twelve Apostles in the list given in Mark 3:16-19 and Matthew 10 2-4. In the corresponding lists in Luke 6 14-16 and Acts 1:14 he is named Judas [son] of James, doubtless to distinguish him from Judas Iscariot. As so named he may be the Judas referred to in John 14:22. Some inferior manuscripts in the lists of Mark and Matthew substitute Lebbæus for Thaddæus, a reading possibly due to some scribe who, ignorant of the identity of Levi with Matthew, introduced the former into the apostolic list under this name. The ecclesiastical historian Eusebius of Cæsarea makes Thaddæus one of the Seventy, and refers to him as sent by Thomas the apostle to Abgar, King of Edessa, in fulfillment of a promise of Christ to him to heal him of an incurable disease and to evangelize his household. Eusebius claims to have taken this story direct from Syrian sources. In the Greek *Acts of Thaddæus* the apostle is identified with Lebbæus, and referred to as evangelizing Syrians and Armenians. The Syrian tradition embodied in the *Doctrine of Addai* makes Addai, one of the Seventy, the apostle of the Syrian church.

**THAI** or **TAI**, a group of peoples of Farther India, including the Thos and Muongs in the northeast (Tongking and China), the Shans in the northwest (Burma, Siam, China), the Laotians in the south (the Laos States, French Siam), and the Siamese in the southwest (Siam). The term "Thai" is applied by certain writers to the Siamese in particular, but their proper appellation is rather Little Thai, their ancestors, the Shans, being called the Great Thai. The Thai peoples speak languages belonging to the same linguistic stock. The Siamese present the Thai type, much changed by intermixture with Khmers, Hindus, Kuis, Malays, and other stocks. They are of medium stature and brachycephalic, while the Laotians are shorter and less broadheaded. The primitive Thai type is best seen in some Shan tribes.

**THAILAND.** See **SIAM**.

**THAÏS**, opera in three acts with music by the French composer Jules Massenet, and libretto adapted from the novel of the same name by the French writer Anatole France. The opera was first presented in Paris on March 16, 1894; its first American production was given on November 25, 1907, in New York City. The scene is laid in Alexandria, Egypt, and in the nearby desert in the early part of the Christian Era.

In Act One, a young Cenobite monk, Athanaël, who has journeyed on a mission to Alexandria, returns to the desert monastery disheartened by the paganism of the city, which is controlled by the beautiful courtesan Thaïs. He determines to convert her, and, against the advice of the aged monk Palemon, goes to Alexandria to the home of the wealthy Nicias, once his friend and now Thaïs' extravagant and favored lover. Nicias is amused but good naturedly consents to aid Athanaël in his reform of Thaïs, who presently arrives for supper. Piqued by his aloof manner, Thaïs tries to lure the handsome monk, but he frankly and sternly tells her his purpose in coming. Challengingly, she invites him to her palace, promising to listen to him.

Act Two finds Athanaël in Thaïs' sumptuous apartments. He offers her the love of God for her salvation, and although Thaïs invokes the aid of Venus, Athanaël is able to resist all her blandishments. They hear the voice of Nicias calling her, and Athanaël leaves, telling her he will wait for her outside until dawn should she decide to go with him to seek God's love. Sounds of revelry are heard in the palace as night wears on, but soon Thaïs emerges, resolved to follow Athanaël. He directs her to break the image of Eros which she is carrying, and to destroy by fire all traces of her former life. The revelers try to detain Thaïs but Nicias distracts them by scattering gold among them, and Athanaël and Thaïs depart for the convent. In Act Three, the couple have reached an oasis in the desert. Athanaël is moved to compassion by Thaïs' fortitude on the journey. When they arrive at the convent Athanaël gives Thaïs to the care of the abbess. When he returns to the monastery, Athanaël confesses to Palemon that although he has saved Thaïs, he is sick with earthly love and longing for her. She haunts his dreams, and in a vision he sees her dying. Greatly troubled, he goes to the convent and finds Thaïs lying worn with repentance and self-denial. Athanaël implores

her to return to him, but Thaïs, her soul already at peace, dies as he cries out despairingly.

**THAÏS** (fl. late 4th century B.C.), Athenian courtesan, famous for her wit and beauty. She accompanied Alexander the Great (see ALEXANDER III) to Asia, and, according to the contemporary historian Clitarchus, induced him, during a festival, to set fire to the palace of the Persian kings at Persepolis: this episode provided the theme of *Ode to Saint Cecilia's Day* by the 17th-century English poet John Dryden. After the death of Alexander Thaïs married Ptolemy I Soter (see PROLEMY), King of Egypt, by whom she had two sons, Leontiscus and Lagus, and a daughter, Irene.

**THALAMUS**, in neuroanatomy, a term applied to each of two ovoid nuclei of the brain, situated on either side of the third ventricle, and serving as the principal lower centers of sensation. The term is loosely applied to the tracts included by the thalamic nuclei on both sides of the brain. Ventrally the thalami merge with the hypothalamus, which includes the mamillary bodies and the floor of the third ventricle, from which extends the infundibulum bearing the pituitary (q.v.) body. The function of the thalamus is co-ordination of sensations or gross perception of pain or other tactile stimuli and the reflexes triggered or conditioned by optic stimulation; it is the primary relay nucleus also for the transmission of optic stimuli to the cerebral cortex. The thalamus is considered by comparative anatomists to be the highest center of the "primitive brain", that is, the center in control of bodily actions and reactions in animals lacking distinct cerebral hemispheres. The nerve fibers of each thalamic nucleus are distributed to all parts of the cerebral cortex on both sides of the brain. Most prominent of these tracts is the optic-radiation tract consisting of secondary fibers carrying optical stimuli from the posterior part of the thalamus to the visual center in the occipital lobe of the cerebrum. Nerve fibers leading to the thalamus include spinal tracts carrying pain and somatic sensation stimuli, fibers from the retinas of the eyes, and co-ordination fibers from all parts of the cerebral cortex. The thalamus, in addition to being the principal substation for sensation between the spinal tracts and the cerebral cortex and the center of optic reflexes, is also regarded by anatomists as the center controlling emotion; lesions in this region having been demon-

strated in cases of uncontrollable emotional states, such as laughing and weeping. Endocrinologists have recently discovered that the thalamus secretes a hormone which probably effects emotional development.

**THALBERG**, SIGISMUND (1812-71), Swiss-born pianist, born in Geneva. Thalberg's first appearance was at the age of fourteen, when he played at an evening party given by Prince Metternich. This success was followed up by numerous appearances in Paris. He made tours in 1839 through Belgium, Holland, England, and Russia, and afterward through Spain, Brazil, and North America, finally settling down at Naples in 1858, where he died. His musical compositions comprise more than ninety numbers, principally fantasias and variations.

**THALER**, a German coin, first struck in Joachimsthal, Bohemia, in 1519 and hence called Joachimsthaler, whence the modern name. The thaler, divided into 30 silbergroschen of 12 pfennigs, was the German unit of value until 1873, when the mark was adopted.

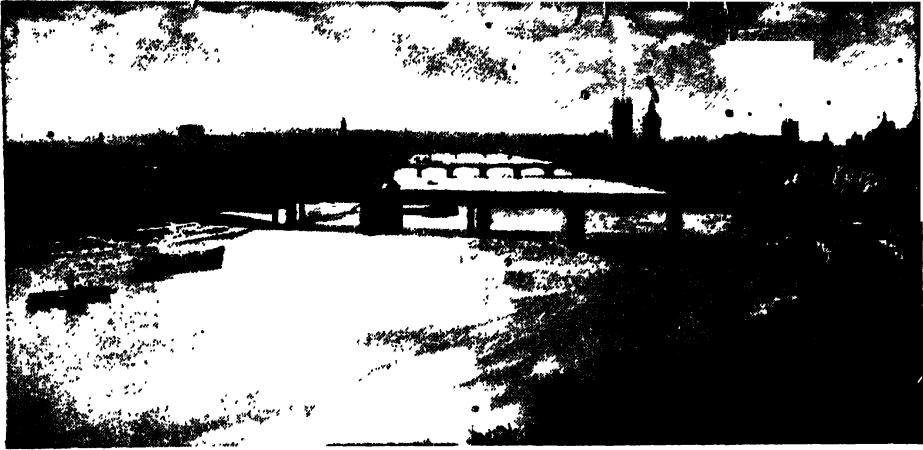
**THALES** (about 640-546 B.C.), Greek philosopher, born in Miletus, Asia Minor. He was the founder of the Ionian school (q.v.) of philosophy, and was considered one of the Seven Wise Men (q.v.) of Greece. Thales was famed for his knowledge of astronomy, and predicted an eclipse of the sun which occurred on May 28, 585 B.C. He also, by founding the geometry of lines, established the science of abstract geometry. Thales is regarded as the first Greek to have speculated on the nature of the universe, seeking a first principle. According to him the original principle of all things is water, from which everything proceeds and into which everything is again resolved. Although Thales left no writings, and even among the ancient Greeks considerable doubt prevailed as to his exact teachings, he is given the title of father of Greek science and philosophy.

**THALIA**, one of the nine Muses (q.v.) of the ancient Greeks. In the assignment of specific functions to the Muses, Thalia became the muse of comedy and pastoral poetry, and was represented as holding the comic mask.

**THALICTRUM**, a genus of hardy, perennial herbs belonging to the Crowfoot family, Ranunculaceae, and commonly called meadow rue. The genus, which contains approximately 90 species, is native to temperate and tropical regions throughout the world,

and is cultivated extensively in gardens of the U.S. The small, petalless, greenish-white, purple, or yellow flowers, arranged in corymbs and loose panicles, have four or five petallike sepals, numerous stamens, and a solitary pistil. The fruit is a single-seeded achene. Feathered columbine, *T. aquilegifolium*, is a white-sepaled, purple-stamened species native to Europe and N. Asia, and attaining a height of 3 feet. *T. dipterocarpum*, native to Yunnan Province in China, has large, rose-colored flowers and is slightly smaller than the feathered columbine. Common American thalictiums include *T. confine*, a small species, growing 20 in. high, native to the mountainous regions of South Dakota. The early meadow rue, *T. dioicum*, bears numerous greenish-white or purple flowers, and is found in E. North America from Labrador to Alabama. It attains a height of 2 feet. The stonefruit rust disease, *Tranzschelia punctata*, is a common enemy of *Thalictrum*.

**THALLIUM** (Gr. *thallos*, "a young shoot"), a metallic element of atomic number 81, atomic weight 204.4, and symbol Tl, insoluble in water and soluble in nitric and sulfuric acids (qq.v.). It was discovered spectroscopically in 1861 by the English chemist Sir William Crookes, who named it from the green line it produces on the color spectrum. It was first isolated by the French chemist Claude August Lamy in 1862. Thallium ranks 61st in abundance among the elements in the earth's crust, and is a member of the aluminum family of metals. It occurs in combination with pyrites, zinc blende, and hematite, and is often recovered from the flue dust produced by pyrite ovens in which sulfur and iron are separated. Occasionally it is extracted from the mud produced in the lead chambers used in manufacturing sulfuric acid. A few deposits of thallium-rich pyrites occur in Sweden and Macedonia. Thallium has a bluish-gray color which turns to dark gray upon exposure to the atmosphere. It has a specific gravity of 11.9, melts at 303.5°C. (578.3°F.), and is very soft and malleable. It forms two series of salts, such as thallous chloride, TlCl, and thallic chloride, TlCl<sub>3</sub>, which are univalent and trivalent respectively. Thallous oxide, Tl<sub>2</sub>O, a black solid which, when molten, attacks glass and porcelain, is made by heating thallium in air at very high temperatures. Thallium salts, which are very poisonous, are used in insecticides and rodenticides. Thallium has a high index of refraction, and



British Information Services

*The Thames River flowing through London, England*

is therefore important in the manufacture of several types of optical glass.

**THALLOPHYTA**, the most primitive of the primary divisions or phyla of the Plant kingdom, including the algae, bacteria, fungi, lichens, and myxomycetes (qq.v.). All thallophytes which reproduce sexually are characterized by the possession of unicellular sex organs. See BOTANY: *Classification*.

**THALLUS**, a vegetable body showing little or no differentiation into leaf, stem, and root, and characteristic of the *thallophytes* or lower Cryptogamia, including algae, fungi, and lichens. Even in the higher members of the ascending series the thallus has neither true vessels nor woody tissue.

**THAMES**, an estuary of Connecticut stretching from New London on Long Island Sound for 15 miles as far as Norwich, where it receives the waters of the Shetucket, Quinebaug, and Yantic rivers.

**THAMES**, the most important river in Great Britain, flowing with a southeastern trend through the southern portion of the kingdom and passing through London.

Its headwaters, rising on the southeast slope of the Cotswold Hills, in Gloucester, five miles s. of Cheltenham, converge on Oxford and flow thence in a southeasterly direction to Reading, through a gap in the Chiltern escarpment. The Thames thereafter follows a generally eastward trend. A few miles below Gravesend it expands into a wide estuary and enters the North Sea. Its length is about 215 miles. The upper part of the river is sometimes called the Isis. At London Bridge the width of the river is

about 290 yards; at Woolwich, 490 yards; at Gravesend pier, 800 yards; 3 miles below Gravesend, 1290 yards; at Nore Light, 6 miles; and at its mouth, between Whitstable and Foulness Point, about 8 miles below the Nore, the estuary is 18 miles across.

The London docks embrace more than 35 miles of the river from the Tower Bridge to Tilbury Dock, and the largest steamships are moored at these docks. While the upriver docks are tidal, the lower admit any vessel at any stage of the tide.

The Thames is also the main source of the water supply of London, the daily supply delivered exceeding 225,000,000 gallons. The part of the river immediately below London Bridge is called the Pool, and the part between the bridge and Blackwall is called the Port. Two embankments have been formed, one on the north shore from Blackfriars Bridge to Westminster, and one on the south shore from Westminster Bridge to Vauxhall. Among the historic and otherwise noteworthy places on the Thames are Putney, Mortlake, Hampton Court, Twickenham, Richmond, Staines, Eton, Windsor, and Henley.

**THAMES, BATTLE OF THE.** After the complete failure of the invasion of Canada under Hull, Van Rensselaer, and Dearborn, and the defeat of General Winchester, the British and Indians took the aggressive, and the prospects of the success of the Americans in the war with Britain (1812-14) seemed gloomy. In the beginning of 1813 the British invaded Ohio and attacked Fort Meigs and Fort Stephenson, and at the latter place

suffered defeat when the Americans became aggressive, and Perry's victory at Lake Erie enabled him to convey Harrison's soldiers, lying on the shores of Lake Erie, into Canada. The British, under Proctor, were retreating, and were pursued by Harrison beyond Sandwich, until he caught them at a Moravian town on the river Thames, about 30 miles E. of Lake St. Clair. There, with the Indians under the chief Tecumseh, Proctor made a final stand (October 5, 1813). A single charge of American cavalry, however, broke his line, and the Indians alone remained to fight in a severe and close contest. Tecumseh was slain by Colonel Johnson. This was his final victory of the campaign, which broke up the alliance between the British and Indians, and restored to the Americans all that had been lost the previous year.

**THAMES EMBANKMENT**, an important public work in London consisting of broad roads along the Thames, protected on the river side by massive granite walls. The finest portion, the Victoria Embankment, on the north bank of the river, between Blackfriars Bridge and Westminster, was constructed in 1864-70. It has a carriage-way 64 feet wide, flanked by broad footwalks, and is planted with trees and adorned with gardens containing statues of notable men. The obelisk known as Cleopatra's Needle stands near the Adelphi Steps. The Albert Embankment on the right bank, between Westminster Bridge and Vauxhall Bridge, with a 60-foot roadway, was completed in 1869, and the Chelsea Embankment, on the left bank, in 1873.

**THAMUGAS**. See **TIMGAD**.

**THAMYRIS**, in Greek mythology, a Thracian bard who challenged the Muses (q.v.) to a singing contest. He was defeated by them and as a punishment was blinded and deprived of his gift of song.

**THANATOS**, in Greek mythology, the god of death, a son of Erebus and Nyx and the twin brother of Hypnos (q.v.; see also **SOMNUS**), god of sleep, with whom he is usually represented. When Thanatos carried off Alcestis (q.v.), the hero Hercules compelled him to restore her to her husband Admetus (q.v.). See also **SISYPHUS**.

**THANE**, a member of a class in the old English community that stood distinctly below the old nobility (*eorlas*, etc.), but above the mere landowners or *ceorls*. The thanes nearly corresponded to the Norman knights,

and after the conquest of England they were mostly absorbed into the knighthood. After the reign of Henry II the name of "thane" fell into disuse in England.

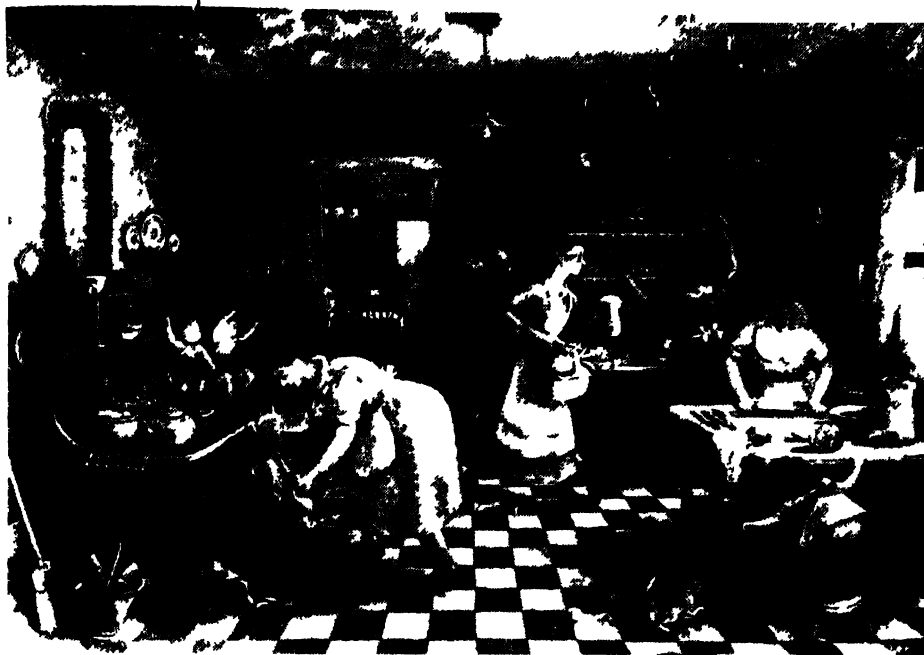
**THANET**, OCTAVE. See **FRENCH**, ALICE.

**THANET, ISLE OF**, the N.W. extremity of Kent County, England, bounded on the N and E. by the North Sea and separated from the remainder of the county by two branches of the Stour R. The Isle of Thanet is approximately rectangular in shape and extends about 8 m. in an E. and W. direction and about 5 m. in a N and S. direction. The chief feature of the terrain is a succession of steep cliffs fronting the North Sea. North Foreland, one of the highest of these headlands, is the site of a famous lighthouse. Thanet is also the site of a number of popular beach resorts, including Margate, Westgate, Broadstairs, Ramsgate, and Minster. During the Roman occupation of Britain, the invaders maintained two forts on the isle. Pop., about 95,000.

**THANKSGIVING DAY**, in America, the name of a national holiday, which originated in New England. After the first harvest of the New England colonists in 1621 Governor Bradford made provision for a day of thanksgiving and prayer. In 1623 a day of fasting and prayer in the midst of drought was changed into thanksgiving by the coming of rain during the prayers; gradually the custom prevailed of appointing thanksgiving annually after harvest. These appointments were by proclamation of the governors of the several New England colonies. During the Revolution a day of national thanksgiving was annually recommended by Congress.

In 1817 New York adopted it as an annual custom, and it spread through many of the States by the middle of the 19th century. In 1864 President Lincoln appointed a day of thanksgiving, and since then the Presidents have issued a Thanksgiving proclamation generally designating the last Thursday of November.

Thanksgivings in the form of sacrifices and of blessings on the Lord for His goodness and mercy were offered frequently in the days of the Patriarchs, the Judges, and the Kings. References to them are numerous in Holy Writ from Genesis to Zechariah. Delivered from the flood, Noah built an altar to the Almighty and thereon offered of every clean beast and every clean fowl burnt offerings unto the Lord in Thanksgiving. Among the ancient Hebrews, bless-



Art Institute of Chicago

*Preparing the Thanksgiving Day feast (painting by the American artist Doris Lee)*

ing or prayers of praise and thanksgiving known as *burakot* were common.

The first official Thanksgiving offered for deliverance from an enemy solemnized in England was solemn Thanksgiving offered at St. Paul's Cathedral in gratitude for the defeat of the Spanish Armada on November 4th of the year 1588. It was attended by Queen Elizabeth in person. After the British people observed solemn Thanksgiving for special occasions only, for Marlborough's victories on November 1, 1707, and September 7, 1704, for George III's recovery from illness, April 25, 1789, for Duncans and other naval victories, December 19, 1797, for the recovery of the Prince of Wales, February 27, 1872, for the defeat of the French off Trafalgar, October 21, 1805, celebrated October 21, 1896, for the sixtieth year of Victoria's reign, June 22, 1897, for the conclusion of peace in South Africa, June 8, 1902, for the recovery of Edward VII, October 26, 1902, and for the end of World War I, November 11, 1918.

**THANN**, a town in the department of Haut-Rhin, France, situated on the Thur, about 16 m. by rail n.w. of Mulhouse. The town is an industrial center, with a stone quarry, metal foundries, and plants

engaged in the production of chemicals, textile, and machinery. Points of interest in Thann include the 14th century Gothic Church of St. Theobald and the ruins of a medieval castle. Pop. about 6400.

**THARRAWADDY**, administrative center of the district of the same name, Pegu Division, Union of Burma, situated about 68 m. by rail n.w. of Rangoon. The district is hilly and contains extensive forests, notably valuable stands of teak. Elephants and numerous other species of wild animals abound in the mountainous areas. Farming is the principal industry and the chief crop is rice. Besides the administrative center, important towns in the district include Letpadin (pop. about 12,000) and Gyobingyik (pop. about 7700). Area of district, 2815 sq. m.; pop. about 594,000. Pop. of town, about 7100.

**THARROS**, in antiquity a Phœnician town in Sardinia, situated on the N. shore of the Gulf of Oristano. The site is about 12 miles w. of Oristano (anc. *Othora*). Archaeological excavations in the nearby necropolis of Tharros have uncovered numerous Phœnician tombs. Tharros was destroyed by invading Moslems in the 11th century.

**THASOS**, the most northerly island in the Ægean Sea, near the coast of Macedonia.

Exports include oil, honey, and timber. The surface is covered with wooded hills, the summit of Hypsaria being 3428 feet high. Area, 167 sq m, pop, about 12,000.

**THATCHER, HENRY KNOX** (1806-80), American naval officer, born in Thomaston, Me. He was admitted as a cadet at West Point (1822). Owing to ill health he did not complete his course, and entering the navy (1823) was commissioned lieutenant (1833). He served during the first years of the Civil War on duty in the Mediterranean. Returning (1863), he took part under Porter in the attacks on Fort Fisher, and succeeded Farragut in command of the Western Gulf squadron at Mobile. He reduced the city, and restored the whole coast to the Union government. Commissioned rear admiral (1866), he was commandant at Portsmouth (1869-71), and was thereafter on the retired list till his death.

**THAULOW, FRITS** (1847-1906), Norwegian landscape painter born in Christiania, and trained at the Copenhagen Academy and at Karlsruhe, Germany. On his return to Norway he joined the new movement in art and about 1880 removed to Paris. His favorite subjects were running water, snow scenes and nocturnes which he interpreted with truthfulness and rare poetic charm. Fine examples are "A November Day in Normandy" (National Gallery, Berlin) and "Winter in Normandy" (Luxembourg Gallery, Paris). Other works are in museums in Munich, Stockholm and Christiania. Thaulow held many exhibitions in the United States, where he is well represented in private and public collections such as that of the Walters Gallery, Baltimore, Md.

**THAUN, PHILIPPE DE** (fl. about 1100-about 1135), the earliest Anglo-Norman poet whose work has come down to us. Thaun probably was a member of a family living near Caen, France, whence he went to England. He wrote *Li Cumpo*, or *Computus*, the so-called *Livre des Creatures* about 1115. It is a poetical treatise in six syllabled lines on the ecclesiastical calendar. Of its seven manuscripts, three are in the British Museum and three in the Vatican. More important is *Li Bestiare* or *Physiblogus*, which the poet probably composed about ten years later. It was dedicated to Adelaide, queen of Henry I. But one manuscript has survived namely, Cotton, Vespasian, E. X. It contains 3194 verses, consists of lines of six and eight syllables, and rhymes in couplets. It is the first French bestiary based on the Latin Physi-

ologus, one of the most noteworthy of the bestiaries. Thaun groups his creatures as beasts, birds, and stones, and treats each creature as a symbol.

**THAXTER, CELIA** (1836-94), American poet, born in Portsmouth, N.H. Her father, piqued at the turn of State politics, retired to White Island Lighthouse as keeper, and his daughter's girlhood was therefore spent in marine surroundings, which colored the best of the verse she later wrote. Her poems, mostly in lyrical form, deal with the beacon light, the sea storm, the glint of sails, the sandpiper and the flower among the rocks, in characteristic and sympathetic fidelity. She also wrote prose sketches of life and scenery. Among the *Isles of Shoals*, stories and poems for children, letters, and also a book on the subject of floriculture, *An Island Garden*.

**THAYER, ABBOTT HENDERSON** (1849-1921), American artist, born in Boston. He studied painting under Gerome at the École des Beaux Arts, Paris. From 1879 to 1891 he painted portraits and landscapes, but after that devoted himself chiefly to figure subjects, a branch of art in which he was conspicuously successful.

His favorite subject was a young female figure alone or in company with one or two accessory figures. They were treated with much idealism and great dignity and charm of expression. Fine examples of his work are "Young Woman" (Metropolitan Museum of Art, New York City), "Ciris" (Boston Museum), "Winged Figure" (Albright Art Gallery, Buffalo), "A Virgin" (Freer collection, National Gallery, Washington, which also possesses several other works) and "Virgin Enthroned." He was elected a member of the National Academy of Design in 1901 and was one of the original members of the Society of American Artists, of which he was president for two years.

**THAYER, ALIX WHITLOCK** (1817-97), American musical critic, born in South Natick, Mass., and educated at Harvard University. While studying law, he developed an interest in music and contributed articles to the press under the pen names of "A Quiet Man" and "A Dilettante." He became musical critic of the *New York Tribune* and wrote much for Groves' *Dictionary of Music and Musicians*. He was (1859-82) United States consul at Trieste. Among his works are *Signor Masoni, and other Papers of the late J. Brown* (1862) and *A Life of Beethoven* (1866-87).



**THAYER, ELI** (1819-99), American inventor, publisher, and writer, born in Mendon, Mass. The great object of his life was an attempt to secure the independence of Kansas as a free State, and he organized two companies, which he subsequently united under the name of the New England Emigrant Aid Company. Lawrence, Topeka, and Manhattan were settled, and greatly contributed to the saving of Kansas for freedom. In 1856 Thayer attempted unsuccessfully a similar undertaking in Virginia. From 1857 to 1861 he was a member of the national House of Representatives. As an inventor he is noted for a hydraulic elevator, a sectional safety steam boiler, and an automatic boiler cleaner. He published a volume of Congressional speeches and a *History of the Anti-Slavery Cause*.

**THAYER, JAMES BRADLEY** (1831-1902). American lawyer, born in Haverhill, Mass. In 1878 he was Royall professor of law at Harvard, in 1885 he was transferred to the professorship which after 1893 was known as the Wild professorship, and which he held until his death. His works include *The Origin and Scope of the American Doctrine of Constitutional Law* (1893), *Cases on Constitutional Law* (1895), *The Development of Trial by Jury* (1896), and *A Preliminary Treatise on Evidence at the Common Law* (1898).

**THAYER, JOHN MILTON** (1820-1906), American lawyer and politician, born in Bellingham, Mass. He settled in Nebraska in 1854, became major general of the Territorial forces (1855), and conducted campaigns against the Indians (1855-61). He served throughout the Civil War, and retired with the rank of brigadier general of volunteers. During 1867-71 he was United States senator, was governor of Wyoming Territory (1875-79), and was governor of Nebraska (1887-93).

**THAYER, JOSEPH HENRY** (1828-1901), American educator, born in Boston. In 1864 he became associate professor of sacred literature at Andover Theological Seminary, and, in 1884 was appointed professor of New Testament criticism at Harvard Divinity School. As a translator he is best remembered for his work on the New Testament grammars. He published a Greek-English Lexicon of the New Testament, and was a member of the American New Testament Company of Revisers of the Revised Version.

**THAYER, SYLVANUS** (1785-1872), American soldier, born in Braintree, Mass., and

educated at the U.S. Military Academy at West Point. He was instructor in mathematics at West Point (1808-12). He served in the War of 1812 at Niagara, Lake Champlain, and Norfolk, and was promoted captain (1813). After visiting Europe to witness the operations of the Allies around Paris (1815), he was appointed superintendent of West Point. During his term of office he so reorganized it that he won the title of "Father of the United States Military Academy". He held the post till 1833 and won the brevet of lieutenant colonel.

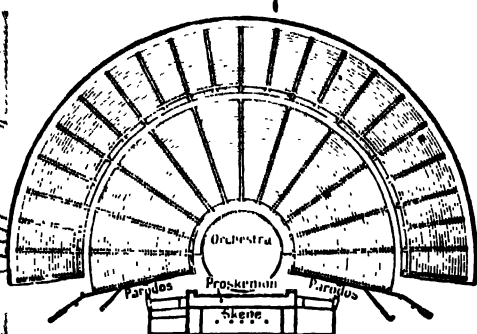
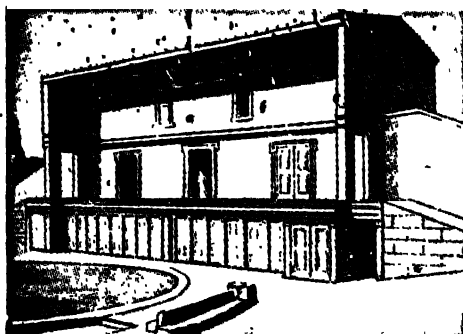
He was subsequently engaged on the defenses of Boston harbor, and retired from the service in 1863 with the brevet of brigadier general. He is buried at West Point, where a statue to his memory was unveiled in 1883.

**THAYER, WHITNEY EUGENE** (1833-99), American musician and composer, born in Mendon, Mass. He was for a time editor of the *Organists' Journal* and the *Choir Journal*, and served as the conductor of the Boston Choral Union and New England Church Musical Association. In 1881 he came to New York, and was until 1888 organist of the Fifth Avenue Presbyterian Church. A prolific composer, his *Festival Cantata* for soli, an eight-part chorus, and orchestra, was his greatest work.

**THAYER, WILLIAM SYDNEY** (1864-1932), American physician, born in Milton, Mass. Professor of medicine at Johns Hopkins (1896-1918), he was the first to report clinically the third sound of the heart, and during World War I he was chief medical consultant to the American Expeditionary Forces in France.

**THAYETMYO**, administrative center of the district of the same name, Magwe Division, Union of Burma, situated on the w. bank of the Irrawaddy R., opposite Allammyo (pop., about 12,500) and about 180 miles n.w. of Rangoon. Farming is the main occupation in the district, an extremely hilly region traversed from N. to S. by the Irrawaddy. Among the chief crops are tobacco, rice, ground nuts, and cotton. The manufacture of silver products is the only important industry in the town. Area of district, 4642 sq.m.; pop., about 297,000. Pop. of town, about 9,300.

**THEATER.** The classical theater arose among the Greeks and was a place devoted to dramatic and musical performances. The central circle was the *orchestra*, in which the chorus sang and danced. Round the



THE ANCIENT GREEK THEATER. Left: Drawing of the stage and back wall (*proskēnion*) of the theater at Epidauros. Right: A ground plan of the theater at Epidauros.

orchestra, the stone seats for the audience rose tier above tier like a large flight of steps. The theater of Dionysus at Athens held nearly 30,000 persons, and that at Megalopolis, 44,000.

The stage was a long, narrow platform, standing about 12 feet higher than the orchestra, and was used by the actors, as distinguished from the chorus. The stage and back wall were called the *proskēnion*; the side walls, or wings, in each of which was an entrance door, being named *paraskēnia*. A flight of steps connected the stage with the orchestra, and these steps, continued out of sight, were the means by which apparitions from the lower world ascended. The wall of the dressing rooms, which formed the back wall of the stage, was ornamented with columns, and represented the front of a temple or other building, before which the action of the play was supposed to take place.

When the action of the play required a different scene, the back of the stage was covered with painted curtains or boards. For machinery there was a platform on which a tableau, depicting an incident which could not be shown on the stage, was rolled forward from one of the doors, exhibited to the audience, and rolled back again. There was also the *mēchanē* (*machina*), by which a god could be lowered from heaven to earth, which was probably some sort of crane. From it we derive the phrase *Deus ex machinā*. In dealing with the early Greek theater it must always be remembered that the stage was only of secondary importance, the orchestra being deemed the chief point of interest.

The Romans, whose theaters were founded in most respects on Greek models, differed

in this point. They transferred all the singing and dancing to the stage, and gave up the orchestra to the most important section of the audience. The most perfect existing specimens of the early Greek theater are at Epidauros, at Aspendus in Pamphylia, and at Athens. At Orange, in the south of France, there is a splendid specimen of an ancient Roman theater.

During the Middle Ages, when the drama existed only in the form of mysteries and miracle plays, and was under the management of the Church, theaters were not required. Plays were represented generally in cathedrals or monasteries, and the most elaborate scenery ever used was a three-story scaffold to represent heaven, earth, and the nether world. In Max Reinhardt's production of *The Miracle*, performed in London (1912), the idea of transforming the Olympia Music-Hall into a vast cathedral came from this medieval practice. With the revival of learning in the 16th century came also a revival of the drama, and theaters began to be built. The earliest was probably a playhouse of some sort in the Hôtel de Bourgogne, Paris, built about 1548; the first regular theater was that which Bramante constructed at Rome (1580), while the earliest theater built on modern lines was constructed by Aleotti at Parma in 1618.

In all the early Continental theaters the construction was founded on Greek models, but in England a simpler idea served. There the earliest dramatic performances took place in booths, on tennis courts, or in the open courtyards of inns; and it was not till the end of the 16th century that the first permanent building was erected for theatrical purposes. This was "The Theater", built by Burbage in Shoreditch in 1576,

which was founded, not on any classical model, but on the inn yards in which the actors had been accustomed to play.

The stage was literally a stage, a platform erected against one side of the building, and on three sides of this platform the spectators stood or sat in the pit (then called the *yard*), while all round it ran the galleries or boxes (then called *rooms*) exactly like the galleries of an inn yard. There was no provision for scenery. The locality in which the scene was laid was indicated only by a ticket stuck up bearing such an inscription as "A Garden", "Thebes", or "Rhodes". *Properties* were, however, largely used to give verisimilitude to the action.

After the Restoration, under the supervision of Charles II, who was familiar with the French stage, the English theater came more into line with the Continental. The stage was gradually withdrawn closer and closer to the proscenium opening, until, by the middle of the 18th century, the appearance of the interior of Drury Lane was not seriously different from that which it presents at this day. In the years immediately following the Restoration elaborate scenery

and the playing of female parts by women were introduced. The first American theater is said to have been at Williamsburg, Va., where an English actor named Hallam played in 1752. Hallam also opened a theater in New York (1753), and at the beginning of the 19th century we find theaters in Charleston, Boston, Albany, Baltimore, and Richmond.

*Modern Theater.* Since the last decade of the 19th century the theater has developed so enormously on all sides that it cannot easily be described in terms of anything previously existing. This change has been due, first, to the literary genius which was thrown into dramatic writing in the second half of the 19th century, an amount of genius greater than the theater has had at any time since the age of Elizabeth; and second, to the rapid progress of the physical sciences, especially in electricity. These two influences have raised the theater from the position of a third-rate institution, scarcely related to literature or the arts, to one of unsurpassed power as a cultural force and an artistic instrument. Dramatic literature, which had for two centuries been held in rigid conventional grooves, has been freed



J. Arthur Rank Organization

Actors on stage of an Elizabethan theater (scene from the motion picture "Henry V")

to take all knowledge as its province. All types of social questions can now be discussed in dramatic form; nearly all genres of literary production have their dramatic parallels; and all types of pictorial and plastic art can be reproduced in the scenic setting. The theater is now the only one of the arts which makes use of all the others. In the last quarter of the 19th century it was absorbing artistic and literary forces from the outside; in the first quarter of the 20th it was established as a creative force and was reflecting back new influences to the other arts.

The modern theater is divided into two or three parts kept distinct in the structural scheme. First, there is the stage, with all necessary dressing rooms and mechanical equipment for the production of the play, together with space at each side and above for the storing of scenery. Next there is the auditorium with its corridors and lounging rooms. Finally, there is the outer lobby with its approaches. This is often made a part of the auditorium structure. There are several modern types of theater differing from the traditional type based on the Italian opera house, which has its balconies in horseshoe shape and its seats generally in curved rows.

Modern practice in theater-building tends to make both the balconies and the rows on the ground floor straight. The larger opera houses, which seat upward of 3000, may have as many as five distinct balconies, including those composed of boxes. But the normal theater for the spoken drama usually has a capacity between 1100 and 1500. A distinct type of playhouse, however, is the little theater, which may have a capacity as small as 99, and rarely goes above 400. This is a direct result of the intimate and lifelike character of many modern plays which demand the most accurate attention. Recently, too, the large outdoor theater, modeled on the Greek, has come into fashion.

In the auditorium, the modern theater has been strongly influenced by German methods. In addition to making straight rows, modern theater architects incline to a steeply pitched floor, sometimes so much as to give the spectators of each row a clear view over the heads of those sitting in front. This type of auditorium is known as the amphitheater, without implying a semicircular plan. Modern custom also tends to the elimination of boxes and loges, or to placing them at the rear. The galleries must of course be

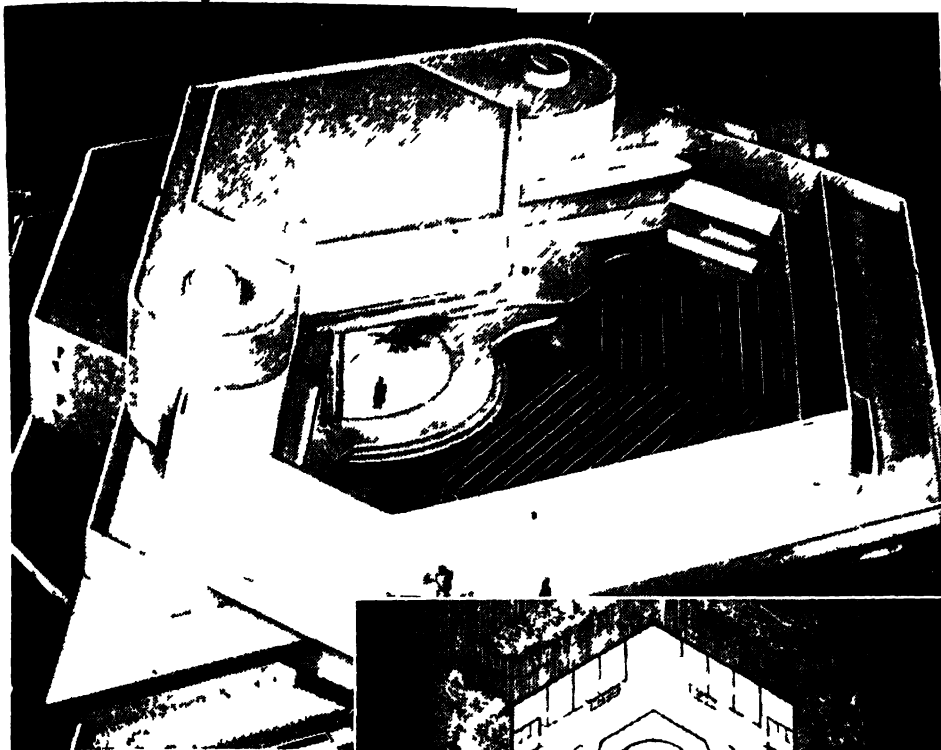
more steeply pitched than the ground floor. In the matter of decoration, too, modern taste follows the German. The ornate quality which is to be found in the Italian opera house is giving place to straight and bare walls, with a simple and harmonious color scheme.

Lighting methods, in recent times, have undergone much change and experimentation, especially in Germany. The "Fortuny system" and related methods throw upon the stage an indirect light reflected from bands of silk or plaster surfaces. Subtle gradations of color can be obtained by the mixing of the primary hues under this method. In some theaters it is the practice to illuminate the stage by means of arc lamps placed in the first balcony, thus eliminating the unreal lighting from beneath that exists under the footlight system.

**THEATINES**, a Roman Catholic religious community, which played, next to the Jesuits, the most important part in the movement for reform from within the Church in the 16th century. Its founders were St. Cajetan (Gaetano da Tiene) and Giovanni Pietro Caraffa, at that time bishop of Chieti, from the Latin title of whose see, Theate, the order took its name. With two other friends, they obtained a charter from Pope Clement VII, dated June 24, 1524, formally constituting the new brotherhood, with the three usual vows, and with the privilege of electing their superior, who was to hold office for three years. They were all to be priests. Their first convent was opened in Rome, and Caraffa was chosen as superior. He was succeeded in 1527, by Cajetan, and the congregation began to extend to the provinces. After a time, however, it was thought advisable to unite it with the somewhat analogous Order of the Somaschians; but Caraffa, who was elected pope, under the name of Paul IV, restored the original constitution in 1555. The Theatines extended themselves over Italy, and into Spain, Poland, and Germany, especially Bavaria. The first French house was founded in Paris under Cardinal Jules Mazarina in 1644. To their activity and zeal many historians ascribe much of the success of the Counter Reformation in the south of Europe. In 1909 Pope Pius X united the order with the Spanish congregation of the holy family at Barcelona.

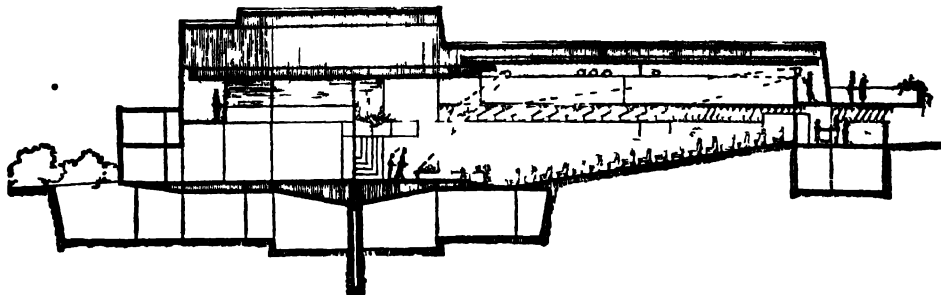
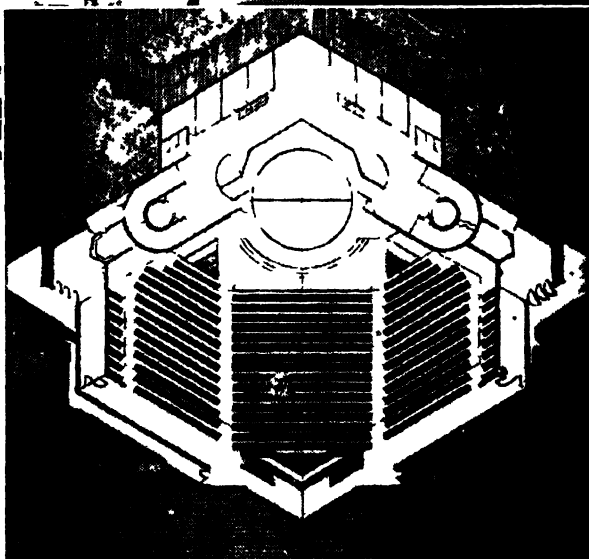
**THÉÂTRE DU VIEUX COLOMBIER.** See COPEAU, JACQUES.

**THÉÂTRE FRANÇAIS.** See COMÉDIE FRANÇAISE.



## MODERN THEATER

Above Overhead view (with roof removed) of "The New Theatre," designed by Frank Lloyd Wright. It introduces many new features in theater architecture. Right Ground plan of the hexagonal structure, showing the seating arrangement and the revolving stage. Below Vertical section shows large space for backstage operations.



**THEATRE GUILD, INC., THE**, an organization devoted primarily to the artistic development of the theater. The plan was first started in New York City by the Washington Square Players in 1916, but World War I put an end to the activity of producing one-act plays. In 1919 the little band of theatrical pioneers reorganized and the Theatre Guild came into existence. The Guild has subscription audiences in about twenty-one cities, and produces an average of six new plays a year and occasional revivals. It presented a weekly radio program entitled *Theatre Guild on the Air* from 1945 to 1953.

**THÉÂTRE LIBRE** (Fr., "free theatre"), the name of a dramatic enterprise founded in 1887 by the French actor and theatrical producer André Antoine, then a young Parisian clerk. With some fellow amateurs he arranged the production (March 30, 1887) of four new one-act plays at the Elysée des Beaux-Arts at Montmartre, and in the course of the year formed the association of the Théâtre Libre, to be conducted upon the following principles: the season was to consist of eight different representations, one each month from October to June; no tickets were to be sold to the public; the enterprise was to be supported by subscribers who with invited guests would form the only audience. The design was to give young authors a chance to try their strength; and also, for art's sake, to produce plays which for any reason, political or moral, might be forbidden by the censorship if undertaken at a public theater. In an artistic way the Théâtre Libre won success, though it excited much debate from the first. Its founder aimed to do away with all conventionality and to attain a degree of realism often thought out of the question upon the stage. In its first eight years about 150 writers contributed works for its performances, and a considerable proportion of these previously unknown pieces were afterward accepted and brought out by other theaters. At the same time such famous writers as Émile Zola, the brothers Edmond and Jules Goncourt, Henrik Ibsen, and Lev Tolstoi also found presentation here. Financially, however, Antoine found his difficulties accumulating, and in 1894 he accepted a position as actor at the Gymnase Théâtre. For a short time he was codirector of the Odéon (1896); then he resumed the direction of the Théâtre Libre, for several years located in the Salle des Menus-Plaisirs and known after 1897 as the Théâtre Antoine.

To this the general public was admitted in the usual way, though subscribers still retained their special privilege at eight representations a year. In 1906 Antoine returned to the Odéon.

**THEBAID**, the title of two ancient epic poems. 1. A Greek epic in 7000 verses, narrating the story of the house of Labdacus, grandfather of Oedipus (q.v.), and the attack of the seven Argive chieftains on the city of Thebes (see SEVEN AGAINST THEBES). The poem is not extant. 2. A twelve-book Latin epic, composed by Publius Papinius Statius (q.v.) and dedicated to the Roman emperor Domitian. Like its predecessor it contains the story of the struggle between Eteocles (q.v.) and his brother Polyneices for the control of Thebes.

**THEBAINE**, a silvery-white, poisonous, crystalline alkaloid in opium. See OPIUM.

**THEBAN CYCLE**, the name given to a series of ancient Greek epics, no longer extant, treating the legends of Thebes. It included the *Thebaid*, the story of the Seven Against Thebes (q.v.); the *Epigoni*, a poem of about 7000 lines, telling of the capture of the city by the descendants of the heroes of the *Thebaid*; and the *Oedipodeia*, attributed to Cinæthion, a Lacedæmonian, and presenting, in about 6000 lines, the tragic story of Oedipus (q.v.), King of Thebes.

**THEBES** (Egypt. *Waset* or *Neut*), a celebrated ancient city and, for many centuries, the capital of ancient Egypt. It was named Thebes by the Greeks, who knew it also as *Diospolis* ("city of Zeus"); it is the city identified in the Old Testament as *Λο* ("city") or *No-Amon* ("city of Amon"). Its site, on both banks of the Nile R. about 480 miles s. of present-day Cairo, is partly occupied by the modern towns of Kainak and Luxor (qq.v.). Scattered over the site, which reputedly had a maximum circumference of 16 m., are the remnants of numerous temples, tombs, and other ancient monuments. Of prehistoric origin, Thebes began to figure in the recorded history of Egypt during the Old Kingdom (3400?-2445 B.C.). Tombs dating from the VIth dynasty (2625-2475 B.C.) of Egyptian pharaohs have been discovered in the original necropolis, which is situated on the w. side of the Nile. As the Biblical name of Thebes indicates, the local deity of the city was Amon (q.v.), originally the Egyptian god of the reproductive forces and, later as Amen-Ra, the "father of the gods". The ruined temple of Amon, which ranks among

the best preserved<sup>1</sup> and most magnificent structures of Egyptian antiquity, is situated at Karnak.

Under the pharaohs of the IXth and Xth dynasties (2445–2160 B.C.), Thebes emerged as the administrative center of a powerful line of nomarchs. The Theban nomarchs successfully challenged the Heracleopolitan pharaohs, winning complete control of Egypt about 2160 B.C. With this event and the establishment of the Theban dynasty of pharaohs,<sup>2</sup> Thebes became the capital of Egypt. The city retained this status until the reign (1375–58 B.C.) of Amenhotep IV. Many of the great temples, the avenue of sphinxes, a number of beautiful tombs, and numerous other lasting monuments were erected in and around Thebes during the period. Thebes was re-established as the seat of the Egyptian government shortly after the death of Amenhotep IV. Subsequently, in particular during the XIXth and XXth dynasties, the pharaohs made additional contributions to the architectural splendor of the city. The Assyrians sacked Thebes in the 7th century B.C. Although it was later partly restored, the city declined steadily after the collapse (332 B.C.) of the New Kingdom. Thebes was destroyed by the Romans late in the 1st century B.C.

Several of the chief ruins of Thebes are described in the articles dealing with Karnak and Luxor. (For additional information on these and other Theban ruins, see EGYPTIAN ARCHITECTURE.) Among the ruined Theban edifices of great archeological importance are the tombs of the pharaohs. These structures, situated in the so-called Valley of the Kings on the w. side of the Nile, were erected between the 16th and 11th centuries B.C. The tomb of Tutankhamen, who reigned about the middle of the 14th century B.C., was discovered in this region in 1922. Other celebrated Theban ruins are the Ramesseum, a temple built during the reign (1292–25 B.C.) of Ramses II, the temple of Ramses III, the temple of Queen Hatshepsut, and the Colossi of Memnon.

**THEBES**, the principal city of Boeotia in ancient Greece, situated N. of Mount Cithaeron, about 44 miles N.W. of Athens. Its acropolis was called Cadmeia, from the legend that it was founded by a colony of Phoenicians under Cadmus (q.v.). No city of ancient Greece was more celebrated in myth and legend. The cycles of myths include stories of the brothers Amphion and Zethus (qq.v.); the tragic fate of its king

Oedipus (q.v.) and the rivalry of his sons, Eteocles (q.v.) and Polydices, which culminated in the expedition of the Seven Against Thebes (q.v.) and the later capture and destruction of the city by the Epigoni (q.v.); the return of the god Dionysus (q.v.) and the introduction of his worship at Thebes; and the birth and exploits of the famous Theban hero Hercules (q.v.).

Thebes in historical times was long an enemy of Athens, and in 479 B.C., during the Persian invasion under Xerxes I (q.v.), the Thebans sided with the invaders and fought against the confederated Greeks at Plataea. When the Peloponnesian War broke out in 431 B.C., Thebes joined the side of Sparta, and at the close of the war was eager for the destruction of Athens; it soon, however, began to dread the heightened power of its ally, and sheltered the Athenian exiles from the rule of the Thirty Tyrants (q.v.). Hence arose a bitter antagonism between Thebes and Sparta, and a struggle ensued which resulted in a short period of Theban supremacy over all Greece, won by the victory of Epaminondas (q.v.) at Leuctra in 371 B.C., and brought to an end by the hero's death at Mantinea in 362 B.C.

The eloquence of the Athenian orator Demosthenes (q.v.) induced the Thebans to unite with the Athenians in opposition to the encroachments of Philip of Macedon (q.v.), but their combined forces were of no avail and in 338 B.C., by the battle of Chaeroneia, the power of Greece was crushed. After the death of Philip the Thebans made a fierce but unsuccessful attempt to regain their freedom; their city was taken by Alexander the Great (see ALEXANDER III) in 335 B.C. and leveled to the ground, the entire surviving population being sold into slavery. Alexander is said to have spared only the temples and the house of the poet Pindar (q.v.). Although the city was rebuilt by Cassander (q.v.) in 315 B.C. and prospered for a time, it had dwindled to a wretched village by the 1st century B.C. At present the site of the acropolis named after Cadmus is occupied by the town of Thebai (pop., about 8000).

**THECLA**, a virgin saint, a member of a noble family of Iconium in Lycaonia, where she was converted by the preaching of St. Paul, and, having devoted herself to a life of virginity, suffered persecutions from her intended bridegroom, and from her parents. She is said to have died at the age of ninety in Seleucia.

**THEIA**, in Greek mythology, a Titaness (see **TITANS**), the daughter of Uranus, god of heaven, and of Gæa, goddess of earth. By her brother, the Titan Hyperion, Theia became the mother of the sun god Helios, the moon goddess Selene, and the dawn goddess Eos (qq.v.).

**THEILER**, MAX (1899– ), South African physician, born in Pretoria, and educated at London University. From 1922 to 1930 he was lecturer and assistant in tropical medicine at Harvard University, and in the latter year joined the staff of the Public Health Division of the Rockefeller Foundation, New York City. He was appointed director of the laboratories of the Division of Medicine and Public Health of the foundation in 1951. Known for his contributions to tropical medicine, Theiler was awarded the 1951 Nobel Prize in medicine. Theiler's works include a monograph contributed to the symposium *Yellow Fever*, published by the Rockefeller Foundation.

**THEINE**. See **CAFFEINE**.

**THEINER**, AUGUSTIN (1804-74), German ecclesiastical historian, born in Breslau, and educated at the universities of Breslau and Halle. Ordained a priest, he entered the Congregation of the Oratory, and became a teacher at the College of the Propaganda in Rome. In 1855 he was placed in charge of the Vatican archives, but was removed from office in 1870 on the charge that he had disclosed confidential proceedings of the Vatican Council to the opponents of the declaration of papal infallibility. His most important work was a new edition of the *Annals* of the Italian ecclesiastical historian Caesar Baronius, with three supplemental volumes. Important also are his collections of documents on the ecclesiastical history of various countries and on the Council of Trent.

**THEISM**, belief in God, and as such opposed to atheism. Theism is now usually understood to mean the doctrine of the One, supreme, personal God, "in whom we live, and move, and have our being", as distinguished from polytheism, which recognizes more gods than one; from pantheism, which denies the divine personality; from agnosticism, which denies that we can know anything of God; and from deism, which, etymologically equivalent to theism, is generally defined as recognizing the personality of God, but denying His providence and active presence in the life of the world.

The four great arguments for theism or belief in God are: (1) the *ontological*

argument first formulated by St. Anselm, which proceeds from the notion of a most perfect being to infer his existence; without actual existence the idea would fall short of perfection. The argument was restated in a different way by Descartes, and is still an element of the claim that without a God the world is a chaos; (2) the *cosmological* argument, employed by Aristotle, Aquinas, and many others, and which is an application of the principle of causality. We cannot conceive an infinite regression of finite causes; therefore beyond the last or first of the finite causes is the Infinite. From motion the argument is to a mover; (3) the *teleological* argument, or argument from design; this argument proceeds from the order and arrangement of the universe, the reign of law and beauty and adaptation, to the intelligent and supreme fountain of order; and (4) the *moral* argument which was relied on by Kant when he destructively criticized the other three; it forms a part of most modern theistic arguments. God is a postulate of our moral nature; and the moral law in us implies a lawgiver without us.

**THEISS**, an important affluent of the Danube, and the chief river of Hungary. It rises by two streams, the Black Theiss and the White Theiss, in the Carpathian Mts. It winds 850 miles n.e., s.w., and finally southward, joining the Danube after running parallel to it for 300 m. The river is famous for its fish.

**THEME**, in music, a subject or motive (q.v.). Every composition is built up from themes which constitute the basic material. In a specific sense, the theme of a fugue is the subject (dux). In variations the theme is a complete musical idea, generally of periodic structure. It is usually played in its entirety before the variations begin. See **SONATA**.

**THEMIS**, in Greek mythology, the personification of justice, who presided over the assemblies of gods and men, and hence the goddess and the guardian of the law and harmony of nature established by the gods. She was considered a Titaness (see **TITANS**), the daughter of Uranus, god of heaven, and of Gæa, goddess of the earth. By her husband Zeus, ruler of the Olympian deities, her children were the Horæ (q.v.) and the Mœræ, or Fates (q.v.); by another husband, a Titan, she was the mother of the hero Prometheus (q.v.). Originally Themis may have been identical with Gæa, for popular



conceptions of the two goddesses seem not to have been sharply differentiated. In art Themis is represented as holding a cornucopia and a pair of scales.

**THEMISTIUS** (about 317–90 AD), Greek rhetorician of Paphlagonia, surnamed Euphrides ("eloquent"). He was a teacher of philosophy and oratory at Constantinople, and was highly honored by several emperors for his high principles and learning. He was tutor to Arcadius, the son of the emperor Theodosius I, and was appointed in 384 AD prefect of Constantinople. The extant works of Themistius include paraphrases of portions of the writings of the philosopher Aristotle and thirty-four speeches which, although chiefly eulogies of various emperors, are valuable for their allusions to contemporary history and their quotations from the ancient philosophers.

**THEMISTO**, in Greek legend the third wife of Athamas (qv). King of Thessaly. Her husband, upon discovering that his second wife Ino (qv) was still alive, sent for her. Themisto, in revenge, planned to slay Ino's children. With this intention, she directed a new slave to clothe her children in white and Ino's in black, but Ino, who was herself the slave in disguise, reversed the command, causing Themisto to kill her own children by mistake. Discovering her deed, she subsequently committed suicide. According to another tradition, Themisto was the first wife of Athamas and the mother of Phrixus and Helle (qqv), although their mother is usually said to have been Nephele.

**THEMISTOCLES** (527?–460? BC), Athenian general and statesman. Upon the defeat of the Persians at Marathon (qv) in 490 BC, Themistocles had the keen insight to realize that only by having a strong navy might the Greeks remain free of Persian domination. After the expulsion of his rival Aristides (qv) in 483 BC, Themistocles controlled Athenian politics and convinced his fellow citizens that a powerful fleet was necessary for their welfare. When it was learned that King Xerxes I of Persia was preparing for another invasion of Greece, and the Athenians had been told by the oracle at Delphi to defend themselves with "wooden walls," Themistocles interpreted this answer as referring to the Athenian ships. The Athenians, terrified, abandoned the city and sent the women and children to the neighboring states; on the eve of the battle of Salamis (qv) in 480 BC, the



*Themistocles, from a vase painting*

Greek forces were about to disperse despite the exhortations of Themistocles to await the attack of the enemy. He is said to have precipitated the conflict by a secret message to Xerxes to attack, but the Greek fleet had an opportunity to flee. He himself commanded the Athenian fleet, which comprised more than half of the total Greek forces, the entire fleet being under the command of the Spartan admiral Eurybiades. The battle of Salamis resulted in a crushing defeat for the Persians, and Themistocles was acclaimed the foremost man of his time.

Eventually, however, his popularity began to wane because his arrogance provoked the anger and resentment of the citizens. He was ostracized (see Ostracism) about 470 BC and retired to Argos, subsequently gaining favor at the court of Artabanus I, King of Persia. The town of Magnesia was appointed to supply him with bread. Lampisacus with wine and Myus with other provisions. He lived at Magnesia until his death. In spite of the discreditable conclusion to his career, Themistocles was a statesman of outstanding ability, and his strong naval policy laid the foundations of the Athenian empire. He also was one of the first Athenians to plan colonization in the west, and he opened Athens to foreign merchants, encouraging trade.

**THEOBALD, LEWIS** (about 1688–1744), early Shakespearian editor and critic, born

in Sittingbourne, Kent, England. He wrote and adapted plays, and made translations from Sophocles, Aristophanes, and other Greek authors. In 1725 Pope published an edition of Shakespeare, which Theobald sharply reviewed in a volume entitled *Shakespeare Restored* (1726). Pope retaliated by making Theobald the first hero of the *Dunciad* (1728). Early in 1734 Theobald brought out his own edition of Shakespeare, in seven volumes.

**THEOBROMA.** See CACAO.

**THEOBROMINE** or **THEOBROMIN**, a white, bitter, crystalline alkaloid,  $C_7H_5N_2O_8$ , obtained in large amounts from chocolate, cacao, kola nuts and tea (qq v), and closely related to the drug caffeine (q.v.). Salts and other derivatives of theobromine are employed extensively in medicine as diuretics.

**THEOCRACY**, literally, "government by God", that constitution of a state in which the Almighty is regarded as the sole sovereign, and the laws of the realm as divine commands. The typical example of a theocracy is that established by Moses.

**THEOCRITUS** (fl. 3rd century B.C.), Greek bucolic poet, born probably in Syracuse, Sicily. Few details are known of his life, except that he spent considerable time on the island of Cos, and lived also at the court of the Egyptian king Ptolemy II Philadelphus, in Alexandria, where he composed several of his poems about 275-270 B.C. and was a member of the *Pleiad* (q.v.) of Alexandrian poets. Thirty-one poems, mostly in dactylic hexameter, and a number of short epigrams have been preserved under his name. His language is for the most part a modified Doric (see GREEK LANGUAGE), but three lyric poems are composed in the literary Æolic, the traditional meter of lyric poetry. Of the longer poems ten are bucolic or pastoral (see PASTORAL POETRY), and three are mimes (q.v.), similar to the recently discovered mimes of Herodas (q.v.). Theocritus raised pastoral poetry to a new and highly perfected form of literature. The poems, each of which represented a single scene of country life, came to be called Idyls ("little pictures"), a name probably not used by Theocritus himself. He introduced into pastoral poetry the themes and conventions adopted by later poets, such as the responsive singing matches of shepherds, the use of invocations and melodious refrains, songs of unrequited love, and dirges sung to commemorate the death of some pastoral hero. Among the Greeks, Theocritus

was imitated by Bion and Maschus (qq.v.); his most successful follower was Vergil (q.v.), who in his *Bucolics*, or *Eclogues*, introduced the pastoral form into Latin poetry.

**THEODICY**, in theology, the justification of the divine providence by the attempt to reconcile the existence of evil with the goodness and sovereignty of God. Leibnitz, the German mathematician and philosopher, was the first to establish the term in 1710, but the theory, as well as the mysterious problem of mixed good and evil in the Creation, which it is meant to resolve, is as old as philosophy itself.

**THEODOLITE**, an instrument much employed in land surveying for the measurement of angles horizontal and vertical. It is larger than the transit and, having larger and more carefully graduated circles, is employed in measuring angles where the highest accuracy is demanded. In its main features it is similar to this instrument, but differs chiefly in that its telescope does not revolve completely or transit in its horizontal axis.

**THEODORA** (about 508-48 A.D.), Byzantine Empress, the wife of Justinian I (q.v.), and said to have been the daughter of Acacius, a keeper of wild beasts at the circus of Constantinople. She was successively an actress, dancer, and courtesan, before becoming the mistress of Justinian, whom she married in 523 A.D. Four years later she was crowned empress and became Justinian's trusted counselor. She bore a chief share in the work of government, and saved the throne by her high courage at the crisis of the Nika riots in 532 A.D., when she prevented Justinian from fleeing and brought about the suppression of the insurrection. Most information concerning Theodora is derived from the *Anecdota*, or *Secret History*, of Procopius (q.v.), who gives lurid details about her early life and describes her as a cruel and tyrannical empress whose numerous spies ferreted out all who were opposed to the government. These details are not supported by other writers, but all authorities agree upon her beauty and intellectual gifts.

**THEODORA** (d. about 867 A.D.), Byzantine Empress, born in Paphlagonia. In 829 A.D. she married the emperor Theophilus, and upon his death in 842 A.D. became regent for her four-year-old son Michael III. Although her husband had been a violent iconoclast, Theodora favored the worship of images; in 842 A.D. she convoked the Constantinople Synod which restored images to

the churches, a triumph annually celebrated in the Orthodox Church by the Sunday of Orthodoxy, the first Sunday in Lent. When Michael came to the throne in 856 A.D., he deprived his mother of her position at court and forced her to enter a convent, in which she died the following year.

**THEODORA** (fl. 10th century A.D.), a member of the Roman nobility. She was very beautiful, of unknown parentage, wife of the consul Theophylact. She ruled Rome and controlled the papacy for a term of years, calling herself by the title of Senatrix. She was the mother of Marozia and Theodora II, who were equally licentious and unscrupulous.

**THEODORE**, King of Abyssinia. See ETHIOPIA.

**THEODORE I**, King of Corsica. See NEUHOF, STEPHAN VON.

**THEODORE OF MOPSUESTIA** (about 350–428), Greek Christian theologian, born in Antioch. About 383 he became a presbyter in Antioch, and about 392 he was chosen bishop of Mopsuestia in Cilicia. He wrote many commentaries, of which remain only, in the Greek, that on the Minor Prophets; in Latin translations, those on the lesser epistles of Paul, and many fragments, especially on the epistle to the Romans. He eschews the allegorical method, adopting the literal meaning, and he takes into consideration also the historical circumstances of the composition, and assumes varying degrees of inspiration. When the Nestorian controversy broke out his writings were attacked, and after a century of agitation were formally condemned by Justinian in the *Triu Capitula* (544). The fifth ecumenical council, that of Constantinople in 533, confirmed the condemnation, and Theodore's name vanished from the list of orthodox writers.

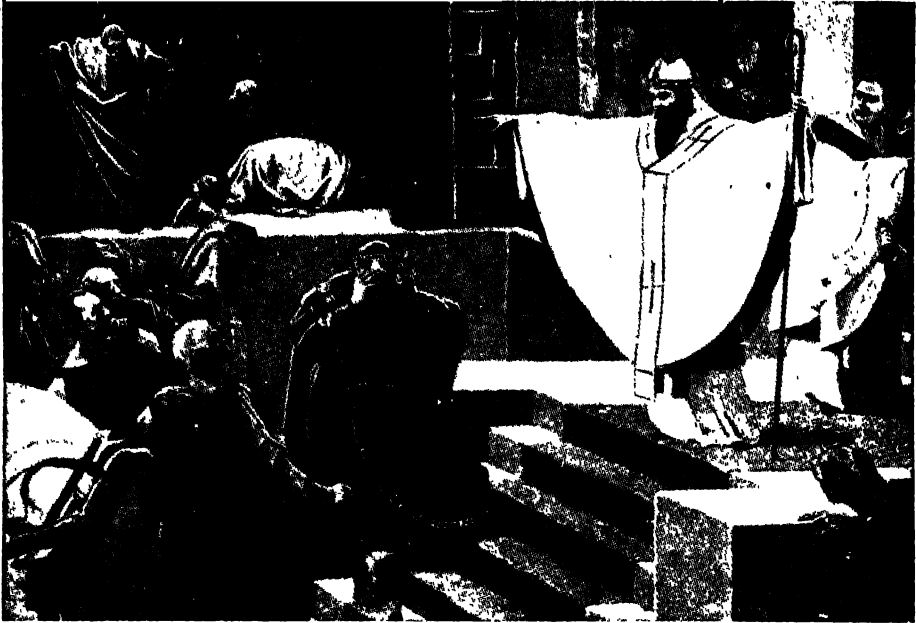
**THEODORE OF TARSUS** (about 602–90), prelate, born in Tarsus, and educated in Athens. He became a monk, early distinguished himself as a scholar, and was familiar with Greek and Latin literature. He was consecrated in Rome as archbishop of Canterbury by Pope Vitalian and arrived at his see on May 27, 669. He did a great work for the Church in England, which at the time of his coming had sunk to a low state. He divided his large dioceses into more manageable ones; appointed worthy bishops; promoted learning and clerical discipline; increased the monasteries; held progressive synods; and so left the Church a compact and enlightened body.

**THEODORET** (about 390–455), Church historian, born in Antioch. He early entered a monastery, and in 423 became bishop of Cyrus, in Syria. As a representative of the school of Antioch he became involved in the Nestorian and Eutychian controversies, and was deposed by the Robber Synod of Ephesus in 449. This was reversed by the general council of Chalcedon in 451. Theodoret wrote much, his chief work being the *Ecclesiastical History*, written in continuation of Eusebius and bringing the narrative down to 428.

**THEODORIC**, reputed son of Alaric, and king of the Visigoths (418–51). He waged successful war against the Romans (425–40), but concluded peace in the latter year with them, and fell in the battle of Chalons-on-the-Marne, fighting on the Roman side against Attila. See GOTHs.

**THEODORIC** or (Ger.) **DIETRICH**, surnamed **THE GREAT** (454?–526 A.D.), the founder of the Ostrogothic kingdom in Italy, born in Pannonia. From the age of seven to seventeen he was a hostage at the court of the Eastern Roman emperor at Constantinople. In 474 A.D. Theodoric succeeded his father Theodemir as head of the Ostrogothic nation, and fifteen years later invaded Italy with the permission of the Eastern emperor Zeno (see GOTHs). Odoacer (q.v.), the first Germanic king of Italy, was defeated in three decisive battles and blockaded in Ravenna; the whole of Italy having been subdued by Theodoric, Odoacer surrendered in 493 A.D. and was treacherously slain by the Ostrogothic king. Theodoric then assumed the title of king of Italy and made Ravenna his capital, occasionally moving his court to Verona when his northern frontier was threatened.

Theodoric's reign of thirty-three years was devoted primarily to the consolidation and development of his new kingdom, and was a period of unexampled peace in Italy. He showed no desire for further conquest, and zealously promoted agriculture and commerce. He ruled all classes of his subjects with irresistible authority, but with justice and moderation, and, although himself an Arian (see ARIANs), exhibited an unusual tolerance of all other sects. The government was administered by Romans on Roman lines; separate codes of law were used for Romans and Goths. Among the Romans who held high office under Theodoric were Anicius Manlius Severinus Boëthius (q.v.) and Flavius Magnus Aurelius Cassiodorus (q.v.);



*Saint Ambrose barring Theodosius the Great from the church*

the former incurred the suspicion of the monarch toward the end of his reign and was unjustly put to death. Theodoric left no son, but was succeeded in 526 A.D. by his daughter Amalasuntha as regent for her son Athalaric. To the Germans Theodoric is known as Dietrich of Bern (Bern being the German name for Verona), and is one of the great heroes of Germanic legend.

**THEODOSIUS I**, called **THE GREAT** (346?-95 A.D.), Roman Emperor, son of Theodosius the Elder, born in Spain, probably in Cauca. He accompanied his father on his British campaigns, but upon the latter's death in 376 he retired to the family estate in Spain. Upon the death of the emperor Valens, the co-emperor, Gratianus, realizing his inability to govern the empire alone, invited Theodosius in 379 A.D. to become emperor in the East. In 380 A.D. Theodosius was baptized as a Trinitarian, or orthodox Christian, and, as a consequence, the restoration of the religious unity of the empire was restored and various edicts against Arianism (see **ARIUS**) and other heresies were promulgated. Upon the murder of Gratianus at Lyons, his rule was threatened by the advance toward Italy of the upstart Maximus, proclaimed emperor in Britain, and the arrival of Valentinian II; Theodosius defeated Maximus at Aquileia

in 388 A.D. and made Valentinian emperor in the West.

For some years thereafter Theodosius lived at Milan, enjoying the friendship and respect of its bishop, St. Ambrose (q.v.). In 390 A.D., when the governor of Thessalonica was lynched by a circus mob for his punishment of a brutal but favorite charioteer, Theodosius ordered the people of the city to be invited into the circus and there massacred. At least 7000 were thus put to death. The subsequent humiliation of Theodosius and his submission to the penance demanded by St. Ambrose for the massacre was regarded by the Church as one of its greatest victories over the temporal power. In 392 A.D. Valentinian II was murdered, and in 394 A.D. Theodosius, then in Constantinople, again marched westward, this time against the Frankish general Arbogast and his puppet emperor Eugenius. After a stubborn fight at the river Frigidus, Theodosius gained a complete victory, and for four months ruled as sole Roman emperor. Upon his death the empire was divided between his two sons, Honorius and Arcadius.

**THEODOSIUS II**. See **BYZANTINE EMPIRE**.  
**THEODOSIUS THE ELDER** (d. 376 A.D.), Roman general, born in Spain. He was sent to Britain by the Roman emperor Valen-

tinian I in 368 A.D. to repel the inroads of the Picts and the Scots and to restore order to the province; he drove out the invaders and repaired the Roman wall. After a victorious campaign on the banks of the Upper Danube against the Alemanni, in 372 A.D. he quelled a formidable revolt in Africa under Firmus the Moor, but four years later was executed at Carthage by order of the emperor Valens.

**THEOGNIS** (fl. late 6th cent. B.C.), Greek elegiac poet, born in Megara. During the conflict in his native city between the aristocratic and democratic parties, in which he took the side of the aristocrats, he lost his estate and was driven into exile. He appears to have visited Sicily, Bœotia, Eubœa, and Sparta, but later, apparently under changed conditions, he returned to Megara. Theognis is the only elegiac poet of the early period whose works are extant in almost complete condition. A collection of his short poems totaling 1389 verses exists, but is believed to have suffered from interpolations. The elegies to his friend Cynrus, which are undoubtedly genuine, are filled with ethical and political precepts and give valuable evidence as to the state of Greek political parties and social conditions of his time. The poetry of Theognis provides the best extant example of that form of verse, embodying moral precepts and general maxims of conduct, known as gnomic poetry (see GNOMES AND GNOMIC POETRY).

**THEOGONY**, in ancient Greece, the name given to a class of poems recounting the genealogy of the gods. The legendary Musæus (q.v.) is said to have written the earliest theogony; but this work, like the theogonies of Orpheus (q.v.) and others, has perished, and the only extant theogony is ascribed to the early Greek poet Hesiod (q.v.). This work sets forth the beginning of things, from Chaos; the marriage of Uranus (Heaven) and Gæa (Earth), and the birth of their offspring, the Titans (q.v.); the overthrow of Uranus by the Titans, and the establishment of the reign of Kronos (q.v.); the latter's marriage to Rhea (q.v.), and the birth of their children; the defeat of the Titans by the children of Kronos, and the establishment of Zeus (q.v.) as king of Heaven; and, finally, the marriages and children of Zeus and of the other chief deities. Although in antiquity the *Theogony* was thought by some not to be the work of Hesiod, most critics, both ancient and modern, agree upon the genuineness of the poem.

**THEOLOGICAL SEMINARY OF THE REFORMED CHURCH IN AMERICA**, a divinity school under the auspices of the General Synod of the Reformed Church, situated in New Brunswick, N.J. It was founded in New York in 1784 and in 1796 was removed to Flatbush, now a part of the borough of Brooklyn. Since 1810 the Seminary has been located in New Brunswick. It has fine lecture rooms, museums, and a fireproof library, which contains 63,000 volumes. Its theology is moderate Calvinism. The Reformed Church was established in America in 1628.

**THEOLOGY**, literally, a speaking concerning God. It is that branch of theological science which treats of God, including (1) the being of God, (2) the attributes of God, (3) the doctrine of the Trinity, and (4) creation and providence. The word first occurs in Plato and Aristotle. Scholasticism understood by theology the whole of Christian doctrine, to which in England the name divinity is given. In its widest sense, the term "theology" now includes all the various theological disciplines, the sacred languages, and the interpretation of the Bible; the history of the church, and the history of religions in general; the contributions of our own age to the knowledge of the objects of theological study from other sciences, such as biology; systematic theology, or the system of doctrines and duties; and, finally, practical theology, or the application of theology to life, in the pulpit, in church administration, and in the various forms of contact with the world. But more strictly and correctly the term "theology" is employed at present of systematic theology, which may be defined as the science of Christianity, of the scientific explanation of the Christian life, the development of its characteristic principles, conditions, and general relations. Viewed thus it yields a system of doctrines and a system of duties, or dogmatics and ethics.

*Dogmatic theology* is the exposition of the dogmas in which the church has found its historical expression. To the end of the 17th century it was for the most part associated with ethics, and the two were combined as *sacra doctrina* or *Theology*, but from that time the separation became general, and the name *dogmatica theologia*, first used by the Lutheran Buddæus in 1724, was applied to the theoretical part of Christian doctrine. It combines the results of exegetical and historical inquiry. It is not

a product of the consciousness of the individual, but is drawn from historical sources.

In what is known as the *New Theology*, the results of historical criticism are applied to a restatement of extegetical theology. It accepts evolution both in the spiritual and material spheres, employs the methods of the higher criticism, rejects verbal inspiration and emphasizes revelation, takes a subjective view of the atonement, minimizes the supernatural, and has a strong tendency to universalism.

**THEON OF ALEXANDRIA** (fl. about 370 A.D.), one of the last of the Greek mathematicians and astronomers. He was a teacher at Alexandria and the father of the celebrated Neoplatonist Hypatia (q.v.), whose name is also connected with the history of mathematical science. Theon's chief works are an edition of the *Elements* of Euclid and a commentary on the *Almagest* of Ptolemy. The former work was prepared by Theon for his students at Alexandria and the various manuscripts of his edition have played an important role in all subsequent attempts to reproduce the original *Elements*. His commentary on the *Almagest* is especially valuable for its notes showing the use of sexagesimal fractions and the operations of division and square root.

**THEON OF SMYRNA** (fl. about 125 A.D.), Greek mathematician and astronomer. He was the author of an extant work, commonly known as the *Expositio*, treating of mathematical rules necessary for the study of the writings of Plato. This work, in two books, comprises a discussion of arithmetic and astronomy.

**THEOPHANO** (about 955-91), wife of Otto II of the Holy Roman Empire, to whom she was married in Rome in 972. She was a woman of great beauty and noble character and soon won great influence over the emperor, in whose court she introduced much of the learning and refinement of Constantinople. After the death of her husband (983) she ruled as regent for her son Otto III till her death.

**THEOPHANY**, an appearance of gods, or of God, to men. In the heathen religions theophanies under various forms were regarded as of frequent occurrence. The term is now generally restricted to the appearances of God as related in the Old Testament, whether in personal form or by any other means, but it is sometimes used for the incarnation of Christ.

**THEOPHILUS** (fl. 2nd century A.D.), Christian prelate. In 169 A.D. he became bishop of Antioch. He wrote an apology for Christianity, in three books, addressed to a pagan friend, Autolycus. The genuineness of his commentary on the Gospels is disputed by modern scholars.

**THEOPHILUS** (6th century A.D.), the hero of a medieval legend antedating the legend of Faust (q.v.). Theophilus was a church-treasurer at Adana, near Tarsus, in Cilicia, and was elected bishop, but refused the honor out of humility; he later quarreled with the new bishop, but on repentance was forgiven. These facts were so embellished by later storytellers that the following legend arose. Theophilus was deposed from his office through slander, gave his soul in bond to the devil, signing the contract with his blood, and consequently was reinstated in office the next morning. He was soon overcome with remorse, and through forty days' fasting and prayer prevailed upon the Virgin to intercede for him. She tore the contract from the devil, and laid it upon the breast of the repentant sinner as he lay asleep in the church. This act became one of her celebrated miracles. The legend first appeared in Europe in the 10th century, and became the subject of poems and dramas in many languages.

**THEOPHRASTUS** (372?-287? B.C.), Greek philosopher, scientist, and author, born on the island of Lesbos. He studied philosophy at Athens, first under Plato and subsequently under Aristotle, whose devoted pupil he became. He is believed to have accompanied the latter to Stagira and to have returned with him to Athens when Aristotle in 334 B.C. opened his school of philosophy in the Lyceum. Aristotle retired to Chalcis in 323 B.C., and Theophrastus succeeded him as head of the Peripatetic School; upon his master's death Theophrastus inherited Aristotle's entire library, the largest then known, including the philosopher's original manuscripts and unpublished writings. Theophrastus lectured at the Lyceum for thirty-five years, during which period he is said to have had 2000 pupils, among them the comic dramatist Menander.

As a writer Theophrastus displayed an amazing versatility and was the reputed author of 227 works. For many years his authority remained paramount in logic, psychology, ethics, politics, rhetoric, physics, and metaphysics. His scientific writings are for the most part lost, but his *History of*

*Plants* and *On the Causes of Plants* are extant; these two works present the first thorough treatment of the science of botany. Also extant are portions of his treatises *On Stones*, *On Fire*, *On the Senses*, and *Metaphysics*; and his book of thirty ethical sketches, called *Characters*, each one depicting a certain type of person, such as the disreputable man, the loquacious man, the tactless man, the surly man, and the superstitious man. The collection *Characters* became famous in world literature, and its form and style were imitated by many French and English writers of the 17th and 18th centuries, notably by Joseph Hall in *Characters of Vertues and Vices* (1608), Sir Thomas Overbury in *A Wife . . . Wherevnto Are Added Many Witty Characters* (1614), John Stephens in *Satyricall Essayes Characters and Others* (1615), John Earle in *Microcosmographie, or a Peerce of the World Discovered* (1628), Jean de La Bruyère in his *Caractères* (1688), and Samuel Butler (q.v.) in *The Genuine Remains in Verse and Prose of Mr Samuel Butler, Author of Hudibras* (1759).

**THEOPOMPUS OF CHIOS** (380?-300 B.C.), Greek historian and orator, born in Chios. As a youth he left home with his father, who had been banished for Spartan sympathies, and lived in Athens and was trained in oratory by the orator and educator Isocrates (q.v.). In addition to numerous panegyrics, of which that on Mausolus, King of Caria, was the most celebrated, the works of Theopompus included the *Hellenica*, a history of Greece from 411 B.C., the point at which the history of Thucydides (q.v.) breaks off, to the battle of Cnidus in 394 B.C.; and the *Philippica*, a history of the life and times of Philip of Macedon, in 58 books, from which the Roman historian Gnaeus Pompeius Trogus (q.v.) derived much of his material. Of Theopompus' writings only fragments remain. A portion of a Greek history found on papyrus in 1907 at Oxyrhynchus (q.v.; see also Papyrus, Discoveries of) has been assigned by several modern scholars to Theopompus, but others attribute it to the historian Cratippus, a younger contemporary of Thucydides.

**THEORBO**, an obsolete musical instrument of the lute family, of which it formed the bass. Besides strings running over the finger board, it had a number of bass strings stretched alongside the board. These strings were longer and were fastened in a sep-

arate neck attached to the neck containing the strings stopped by the fingers. The theorbo was indispensable in the orchestra of the 17th century and was used for accompanying the voice.

**THEOREM**, in mathematics, a proposition to be demonstrated. A theorem consists of two parts: the hypothesis, or the given; and the conclusion, or what is to be proved. One theorem is the converse of another when the conclusion and the hypothesis are interchanged in the two theorems. The converse of a theorem is, however, not necessarily true. A corollary of a theorem is a truth easily deduced from it and not requiring a separate demonstration. A lemma is generally a theorem used to prepare the way for another theorem.

**THEORIES OF AVERAGES.** See PROBABILITIES.

**THEORY.** See HYPOTHESIS.

**THEORY OF EQUATIONS**, the branch of mathematics concerned with finding the solutions of algebraic equations, or proving that such solutions cannot be found. Although many types of equations other than algebraic equations are important in modern mathematics (for example, differential equations; see CALCULUS), the theory of equations is restricted to algebraic equations, and in general to a particular type of algebraic equation. This type of equation contains but one unknown, usually called  $x$ ; the equation states that zero is equal to some function of this unknown, the function consisting of the sum of a number of terms, each term consisting of some known number multiplied by  $x$  raised to some integral power (for example,  $x$ ,  $x^2$ ,  $x^3$ , or in general  $x^n$  where  $n$  is any positive whole number). The number by which  $x^n$  is multiplied in each term is called the *coefficient* of that term, and is often represented by a letter such as  $a$ ,  $b$ , or  $c$ , indicating a known number. The general equation of this type may thus be expressed in the following form:

$$a + bx + cx^2 + dx^3 + \dots + ex^n = 0$$

In this equation any of the known numbers other than  $e$  and  $n$  may be any number, positive or negative or zero, real or imaginary, or complex, the number  $e$  cannot be zero, and, as stated above, the number  $n$  must be a positive whole number. The magnitude of  $n$  is called the *degree* of the equation.

When  $n$  equals one, the equation is of the first degree, and is called a *linear equation*. Every such equation can be expressed in

the form  $ax + b = 0$ , and the solution is easily obtained:  $x = -\frac{b}{a}$ . When  $n$  equals

two, the equation is of the second degree, and is called a quadratic equation. Every such equation can be expressed in the form  $ax^2 + bx + c = 0$ , and the solution is as follows:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Equations of the third degree are called *cubics*, and equations of the fourth degree are called *biquadratics* or *quartics*. These equations are exceedingly difficult to solve. However, the solution of the cubic equation was discovered in the 16th century by the Italian mathematicians Jerome Cardan and Niccolò Tartaglia (qq.v.) and the solution of the quartic equation was discovered by Cardan's pupil Ludovico Ferrari later in the same century. The general solution of equations of higher degree proved extremely difficult, and the *quintic* equation, as an equation of the fifth degree is called, resisted the attempts at solution by the ablest mathematicians of the 17th and 18th centuries. At the beginning of the 19th century the German mathematician Karl Gauss showed that every algebraic equation has at least one root; his proof, however, did not imply that such a solution can be found. In the 19th century the Norwegian mathematician Niels Hendrik Abel, the Irish mathematician Sir William Hamilton, and the French mathematicians Évariste Galois, Charles Hermite, and Jules Henri Poincaré proved that in many cases equations of the fifth and higher degrees cannot be solved, even though such equations have roots. Mathematicians have also shown that every equation of degree  $n$  has exactly  $n$  roots. For example, the equation  $x^2 = 9$  has two roots,  $x = 3$  and  $x = -3$ . The equation  $x^3$

$= 1$  has three roots:  $x = 1$ ,  $x = \frac{\sqrt{-3} - 1}{2}$ ,

$x = \frac{-\sqrt{-3} - 1}{2}$ . Sometimes two or more

of the roots have the same value; for example, the equations  $x^2 - 2x + 1 = 0$  has two roots, both  $x = 1$ .

Extracting the roots of an equation is called solving the equation. Formulas can be found for solving cubic and quartic equations, but these formulas are extremely cumbersome. Such equations are normally solved by *transformations*; the equation is trans-

formed into a different equation, usually of lesser degree, which can be solved, and the roots of this new equation bear a simple known relationship to the roots of the original equation. Equations of the fifth and higher degree can always be simplified by such transformations; for example, any equation of the fifth degree can be transformed into an equation of the form  $x^5 + ax + b = 0$ . However, the latter cannot be solved by means of a finite number of simple arithmetical operations, and in this sense is insolvable. The value of each of the roots can, however, be computed to within any desired degree of accuracy by simple methods. Moreover, the roots can be expressed in terms of the coefficients by various complex mathematical functions. But the roots cannot in general be expressed in such a way that they can be computed from the coefficients by a finite number of additions, subtractions, multiplications, divisions, or extractions of square roots. Only when the roots can be so expressed, can the equation be considered "solved".

**THEORY OF NUMBERS**, the branch of mathematics which deals with the properties and relationships of numbers. According to this broad definition, the theory of numbers includes most of mathematics, and particularly of mathematical analysis. Generally, however, the theory of numbers is confined to the study of integers, or occasionally to some other set of numbers which has properties similar to the set of all integers (an integer is a whole number, as opposed to a fraction). Elementary arithmetic, for example, is part of the theory of numbers, and some of the unsolved problems in this branch of mathematics are no more complicated than ordinary arithmetic.

One of the simple concepts in the theory of numbers is the concept of prime and composite numbers. A composite number may be factored; that is, it is equal to the product of two or more other numbers. A prime number may not be factored; that is, it cannot be divided by any number (other than itself or one) without leaving a remainder which is a fraction. For example, the numbers 1, 2, 3, 5, 7, and 11 are prime; the numbers 4, 6, 8, 9, and 10 are composite.

With increasingly larger numbers, the probability that a number chosen at random will be prime becomes smaller, because there are so many smaller prime numbers which may be factors of it. For example, between



1 and 10 there are five prime numbers; between 1000 and 1010 there is only one prime number: 1009. 1001 is not prime because it is equal to  $7 \times 11 \times 13$ ; 1003 is not prime because it is equal to  $17 \times 59$ ; and 1007 is not prime because it is equal to  $19 \times 53$ . The ancient Greek mathematicians speculated on the possibility of the existence of a number so large that no number larger than it is prime. This problem was solved by Euclid (q.v.) about 2000 years ago. The proof that there is no largest prime number is a typical example of some of the techniques employed in the theory of numbers.

Euclid's proof proceeds by assuming the existence of a largest prime number and then proving the assumption absurd, because there must be larger prime numbers. The proof follows. The largest prime number is defined as  $p$ . The number  $q$  is designated as equal to the product  $1 \times 2 \times 3 \times 4 \times 5 \times \dots \times p$ , where the dots represent all of the numbers between 5 and  $p$ . The number  $r$  is set equal to  $q + 1$ . The number  $q$  must be an even number (i.e., it must be divisible by 2) because 2 is one of the numbers which was multiplied in obtaining it; hence  $r$  must be an odd number, and so not divisible by 2. Similarly  $q$  is divisible by 3, and hence  $r$  cannot be divisible by 3. Similarly,  $r$  cannot be divisible by any number up to and including  $p$ . Hence  $r$  is either a prime number, or else it is a composite number the factors of which are prime numbers larger than  $p$ . In either case,  $p$  is not the largest prime number. But whatever the largest prime number might be assumed to be, one can always, by this method, find a larger prime number. Hence, no largest prime number exists.

The above proof indicates the essentially simple nature of some of the theorems in the theory of numbers. Others of the theorems are extremely complex. For example, mathematicians long wondered exactly how many primes there are in the first million numbers, or in the first billion numbers, or in the first trillion numbers. It is impossibly difficult to make this calculation by simple methods. To find out whether such a number as 13,692,487 is a prime number is an extremely arduous task, because a mathematician must attempt to divide it by each smaller prime number, and discover whether there is a remainder. Formulas have been worked out for predicting the number of primes in the first  $n$  numbers (where  $n$

in any number), but the methods of deriving these formulas involve mathematics which would be far beyond the average college graduate. (The number of primes in the first  $n$  numbers, if  $n$  is extremely large, is approximately  $n$  divided by the natural logarithm of  $n$ .)

For an example of a famous unsolved problem in the theory of numbers, see FERMAT'S LAST THEOREM. See also INDETERMINATE EQUATIONS.

**THEOSOPHICAL SOCIETY**, a religio-philosophical organization founded in New York City in 1875 by Elena Petrovna Blavatsky, with the assistance of Henry Steel Olcott and William Quan Judge (qq.v.). In 1879 the international headquarters were transferred to Adyar, near Madras, in India, where the Society maintains a tract of three acres on the Adyar River, with numerous buildings, including a library, printing plant, auditorium, business offices, and residences. The objects of the Society are to promote the universal brotherhood of mankind; to investigate the ancient religions, philosophies, and sciences of the world; and to make systematic inquiries respecting the occult powers of man. Since it was instituted in 1875, the Society has established over sixty national organizations on five continents. The American organization is known as *The Theosophical Society in America*. Each national organization is autonomous and carries on its work of study and teaching in small groups, known as lodges or branches, which are also autonomous.

The first president of the Theosophical Society at Adyar was Olcott. He was succeeded in 1901 by Annie Besant (q.v.), who visited the United States in 1926, bringing with her the young Hindu Krishnamurti, whom she claimed to be the chosen vehicle through which the "Messiah" or World Teacher would speak when he should come again. Dr. George Arundale, the present head of the Theosophical Society, succeeded Annie Besant in 1934. The American organization has its headquarters at Wheaton, Illinois, where it maintains a spacious executive and student building constructed in 1927 on a forty-acre estate. The world membership of the Theosophical Society prior to World War II was about 40,000.

**THEOSOPHY** (fr. Gr. *theos*, "god"; *sophos*, "wise"), the designation for any religio-philosophical system purporting to furnish authoritative knowledge of God, and of the universe in relation to God, by means

of direct mystical intuition, philosophical inquiry, or both. The earliest examples of theosophic thought are found in the Sanskrit metaphysical treatises known as the Upanishads (q.v.). All Hindu philosophy subsequent to the introduction of the Upanishads (about the 8th century B.C.) has been predominantly theosophic in tone. From India this form of speculative philosophy was transmitted to Persia, where it was adopted by the Arabs after their conquest of Persia in the first half of the 7th century A.D. In China, the *I Ching* ("Book of Changes"), one of the so-called Five Classics (see CHINESE LANGUAGE AND LITERATURE) of the Confucian (see CONFUCIUS) religion, and the *Tao Tê Ching* ("Book of the Virtuous Way"), the chief treatise of the religio-philosophical system known as Taoism (q.v.), both contain theosophic elements. A distinctive theosophy was expounded in the Cabala (q.v.), a mystical interpretation of the Scriptures current among the Jews of Europe between the 12th and 16th centuries. The doctrines of the Cabala were profoundly influenced by two Western theosophic systems, namely, Neoplatonism (q.v.), as represented in the writings of Ammonius Saccas, Plotinus, Porphyrius, and Proclus (qq.v.), and Gnosticism (q.v.), as exemplified chiefly in the works of Basilides and Valentinus (qq.v.). In the Middle Ages theosophic teachings were expounded by Johannes Eckhart (q.v.), Johannes Tauler (1300?-61), and Theophrastus Bombastus von Hohenheim, known as Philippus Aureolus Paracelsus (q.v.), and in later periods, by Robert Fludd, Jakob Böhme, and Jan Baptista van Helmont (qq.v.).

In modern times, the term "theosophy" has been employed with particular reference to a system of occult philosophy set forth by Madame Elena Petrovna Blavatsky (q.v.), who maintained that she had received her doctrines from various Oriental religious teachers who were supposed to have reached a higher plane of existence than that of other mortals. The concepts and terminology of Blavatsky's system are derived for the most part from Buddhism and Hinduism (qq.v.; see also THEOSOPHICAL SOCIETY). According to her teaching, God is infinite, absolute, and unknowable. No attempt is made, therefore, to qualify or describe the Great Unknown, which is held to be the source of both spirit and matter. Spirit and matter are regarded as the two indissociable aspects of one root nature. By the operation

of an immutable law, spirit is said to descend into matter, and matter to ascend into spirit. Thus a cyclical action is posited, from spirit downward to matter, and from matter upward to spirit.

In the cosmological application of this theory, all worlds are represented as passing through seven great periods of manifestation, called rounds. Spiritual at first, these worlds become denser and darker in their descent toward materiality, until they reach the fourth and densest round (corresponding to the present condition of our own material world). Thence begins their upward movement toward spirituality through the three ascending rounds. In its psychological application, the theosophic doctrine represents all souls as being the same in essence, although differing in degrees of development. The more advanced souls are supposed to be the natural guardians of the less developed.

Man, according to the theosophists, is composed of seven principles, which are divided into a lower (mortal) and higher (immortal) nature. The lower nature, constituting man's personality, is fourfold. Of this fourfold nature, one fourth, constituting the physical body, is visible; the remaining three fourths are invisible. These three invisible principles are, respectively, the astral body, a subtle counterpart of the physical body, on which are molded the physical atoms; the life principle; and the principle of desire. The physical body is matter without form; it receives its form, or "entelechy", from the astral body, and is animated by the principle of desire. This fourfold nature, common to all animal beings, is mortal and subject to dissolution at death. The higher nature of man is threefold, and comprises the mind, soul, and spirit. This higher nature, when freed by death from the trammels of the lower nature, ascends to heaven, in which it enjoys a period of happiness and tranquillity proportionate to its virtuous thoughts and high ideals while on earth. With the exhaustion of its accumulated good, however, the higher nature descends once more to earth.

One mundane life is not sufficient to effect the total redemption of the soul from the corruption of its lower nature, hence the cycle of birth-death-rebirth through which the soul must pass until it has altogether purged away the moral consequences of its earthly deeds, both good and evil (see TRANSMIGRATION). By purification and training of the body, the theosophists maintain,

the divine powers latent in man are activated. The bonds of personality then no longer bind him to the attractions of the senses. Having consciously related himself to the source of his being, he becomes one with the divine. See also METAPHYSICS; MYSTICISM; OCCULTISM; VIDANTA.

**THEOTOCOPULI**, DOMENICO See GRECO, EL.

**THERAMENES** (455?-404 B.C.), Athenian statesman and soldier. In 411 B.C. he was one of the leaders in the establishment of the oligarchic rule of the Four Hundred, but four months later aided in the overthrow of that body and the setting up of the democratic rule known as the Five Thousand, based upon constitutional forms. Theramenes fought in the Peloponnesian War, taking part in the battle of Cyzicus in 410 B.C. and in the siege of Chalcedon and the capture of Byzantium two years later. At the battle of Arginusæ in 406 B.C., as a subordinate officer of the Athenian fleet, he was ordered to rescue as many crews as possible, but was unable to carry out the order because of a severe storm; he then hastened to Athens and was instrumental in having the Athenian generals condemned for negligence. In 404 B.C. he was one of the negotiators of peace with Sparta and was chosen one of the Thirty Tyrants (q.v.); being opposed to the violence of the extreme members of the group, he was accused by Critias (q.v.) of being a traitor and was put to death.

**THERAPEUTÆ**, an ascetic sect, mentioned in the *De Vita Contemplativa*, doubtfully ascribed to Philo, as living chiefly on Lake Mareotis, near Alexandria. Their discipline resembled that of the Essenes. Throughout the week each lived in his lonely dwelling, but on the Sabbath they assembled for worship.

**THERAPEUTICS**, the science of healing; that division of medicine which treats of the actions of remedies on the diseased animal system, or the means by which nature can be aided in return to health. The conception of disease which is found among primitive races is associated with the idea of demon possession. The earliest therapeutic measures were devoted to driving out these demons from the bodies of their victims. Two methods were employed: one consisted in the recital of charms or magic over the ailing part, or over the sick person; and the other consisted in internal administration or external application of certain aromatic or bitter herbs. In the early history of both

Eastern and Western nations, there was a blending of the office of priest and physician.

Among the ancient Egyptians, the treatment of disease had acquired a character by no means unscientific. They used remedies of vegetable, mineral, and animal nature, many of acknowledged value. Careful directions as to administration of drugs and indications for their use have been found. Egyptian physicians' knowledge of hydrotherapy, dietetics, and hygiene was far advanced. Among the Hebrews the infliction and cure of diseases is on various occasions in Scripture ascribed to the direct interposition of God. Their methods of treatment consisted principally of strict hygienic means, attention to diet, ablution, separation, and combustion of infected garments. A large list of remedies is mentioned in the Bible.

The Chinese assert that with them the study of medicine was coeval with the foundation of their empire. They possess work on treatment of great antiquity. Ginseng they regarded as a panacea, and also employed opium, mercury, and many other drugs of value. The Greeks may have borrowed something from the Eastern nations of their knowledge of medicine and treatment; but researches have shown that under the scientific spirit of Hippocrates they had evolved a fairly good system. Hippocrates ascribed disease to alterations of the humors of the body (the blood, phlegm, and yellow and black bile). He employed baths, diet, exercise, blood-letting, the actual cautery, and an extensive series of medicines. Galen represented the highest development of Greek medicine. He explained the operation of drugs by reference to their elementary qualities, heat, cold, dryness, and moisture.

In the early periods of Roman history medicine was practiced by the slaves and freedmen and its highest development was reached under the influence of the Greek school. In the Dark Ages medicine was practiced by the monks. Magic and astrology were potent influences. Toward the middle of the eighteenth century the practice of therapeutics had reached a most complicated stage. There were theories and countertheories, and physicians were prescribing huge doses of unpleasant mixtures in the hope of securing good from all the remedies recommended. A natural reaction set in which resulted in the establishment of homeopathy.

Modern therapeutics may be said to have begun with the discovery of morphine, an alkaloid of opium, in 1817. The present

method of treatment is embodied in rational therapeutics, which implies the use of remedies based on a knowledge of the diseased condition present in the patient, a knowledge of the nature of disease itself, and of the physiological action of the agent employed, as determined by experimental investigation on animals, from which may be deduced the action on men. The knowledge of the action of drugs must include the manner in which they effect nerve centers, respiration, circulation, and especially their influence on blood pressure and on body temperature. The range of medicinal doses, as well as the minimum and maximum fatal doses, must also be determined.

In treating disease it is the aim of the physician to seek the cause of the condition present and to endeavor from a true appreciation of the knowledge of drug action to administer curative remedies. A remedy which will usually cure a certain disease is called a specific. Such is the action of mercury and salvarsan in syphilis, and quinine in malaria. Empirical therapeutics was based on the cumulative evidence that certain drugs were of service in certain conditions, and experiment was the sure guide. Symptomatic treatment aims to relieve the symptoms of disease irrespective of their cause. Rational or scientific therapeutics recognizes that both these previous methods may have to be followed at times, but it aims especially at the removal of the cause of disease by appropriate treatment of whatever sort. It has been developed by the increased knowledge of disease which we have acquired through the growth of the sciences of pathology and bacteriology. *Materia medica* comprises a knowledge of the remedies employed in medicine; while the methods by which drugs are prepared and combined for administration, as well as the separation of the active principles of drugs, belongs to the department of therapeutics known as pharmacy. It is essential that there should be a uniform standard of strength and purity of medicinal products, as well as uniformity in their preparation, and to attain this object the various countries have standards established by law or by professional authority, to which the drugs prepared by the pharmacists must conform. These standards are published by each nation in works known as *Pharmacopœias*. The first United States *Pharmacopœia* was published in 1820, previous to which time European works were used. This work

is revised every ten years by a committee of physicians and pharmacists. Those preparations which follow its direction and are named in the work are called official. Unofficial preparations, including many newer drugs, are in use. Some of these, provided they are of sufficient value, are included in the *Pharmacopœia*.

The term "therapeutics" is usually restricted to the administration of medicinal drugs, but in its broadest sense, general therapeutics, it includes every form of treatment. Natural therapeutics is the healing power of nature to cure disease through the operation of the so-called *vis medicatrix naturæ*. In what is known as expectant treatment the physician depends solely on this force and sustains the patient's strength by food and nursing. Treatment by surgical means is regarded as a special and separate department of medicine. A large number of other means than treatment by drugs are in use and each is designated by an appropriate prefix. Electrotherapeutics, the use of electricity as a healing agent, is especially valuable in certain cases of disease of the nervous system or local injury to a nerve. Radiotherapy or X-ray therapy is the use of the Röntgen rays. Suggestive therapeutics is the name given to treatment in the form of suggestion made to the patient while in an induced hypnotic state, with the object of the patient's following the suggestion when out of the hypnotic state. Thermotherapeutics is the treatment of disease by the application of heat. Therapeutics fully recognizes the value of diet in disease in the department known as dietetics or dietotherapeutics. See CLIMATHERAPY; HYDROTHERAPY; LACTIC ACID THERAPY; MECHANOTHERAPY; PSYCHOTHERAPY; SECRETIONS, INTERNAL.

**THERAPIA**, a Turkish town on the Bosphorus, 15 miles N.E. of Istanbul. It is the summer residence of the ambassadors.

**THEREMIN**, LEO (1896- ), Russian musician and engineer, born in St. Petersburg (now Leningrad), and educated at the University of St. Petersburg and at the St. Petersburg Musical Institute. In 1919 Theremin was made director of the Laboratory of Electrical Oscillations at the Leningrad Physico-Technical Institute; soon afterward, he invented an electronic musical instrument which bears his name. The initial public demonstration of the theremin was given by its inventor in August, 1920, at the Eighth All-Soviet Union Electrical Congress. Seven years later Theremin visited the United

States, giving a series of recitals on his instrument in New York and other principal cities. He returned to the Soviet Union in 1938.

The theremin consists of a compact cabinet, from the right rear corner of which a vertical, antennalike rod projects; from the left side a loop of metal extends in an almost horizontal direction. Musical sounds are generated by two vacuum-tube oscillator circuits. One of these circuits functions at a fixed frequency; the frequency of the other circuit is controlled by the motions of the instrumentalist's hand in the air close to the vertical rod. The pitch of the sound emitted by the instrument is raised or lowered as the hand of the performer is moved toward or away from the rod; a range of approximately six octaves may be achieved by moving the hand within a radius of about three feet from the rod. Volume is controlled by a switch, which is located on the front panel of the cabinet and fixes the volume level, and by the motion of the instrumentalist's left hand above the horizontal loop of metal on the left side of the cabinet. When the hand is raised upward from the loop the volume of the tone is amplified; conversely, when the hand is lowered the tone diminishes until it finally becomes inaudible. Few compositions have been written especially for the theremin as either a solo or ensemble instrument; among the most notable is the *First Airphonic Suite* (1924), by the Russian-American composer Joseph Schillinger.

**THERESA**, SAINT. See TERESA.

**THERESOPOLIS**, a summer health resort in the State of Rio de Janeiro, Brazil, 25 miles N.E. of the city of Rio de Janeiro, 2600 feet above sea level.

**THEREZINA**, the capital of Piuhby State, Brazil, on the Parnahyba River, with cotton mills and soap works. Pop., about 58 000.

**THERIODONTIA**, an animal classification, proposed by Owen, to include the mammal-like reptiles with mammallike teeth, from the South African Karroo formation. The group has since been subdivided, the Lower Permian types forming the Therocephalia, and the Upper Triassic, the Cynodontia.

**THERMÆ**, hot springs or baths, specifically the public baths of ancient Rome. Although early Roman thermæ were comparatively modest in size, those built by Marcus Vipsanius Agrippa about 21 B.C., and during the empire by the emperors Titus, Trajan, Caracalla, and Diocletian, were of immense size and complexity; those of Caracalla and

Diocletian are the best preserved. Late thermæ consisted of numerous chambers, including the *apodyterium*, a room for undressing and dressing; the *tepidarium*, a moderately warm anteroom; the *caldarium*, a room for the hot bath; the *frigidarium*, for the cold bath; and the *unctorium*, a room for the rubbing and anointing of the body with oil. The rooms were heated by underground furnaces, floor ducts, and flues behind the walls. The late imperial thermæ were the center of the public life of Rome and provided libraries, halls for clubs and lectures, gardens, porticoes, running tracks, and many other features for exercise and recreation. The most elaborate structure was that built by Diocletian in 305 A.D., said to accommodate over 3000 bathers at once, and occupying a square more than 1000 ft. in each direction. The extensive ruins of this building today house a large church, Santa Maria degli Angeli; the great National Museum, in rooms formerly occupied by a monastery; and educational and philanthropical institutions. See BATH: Rome.

**THERMAL SPRING**, or HOT SPRING, a spring with a temperature higher than the average temperature of the locality in which it emerges. When the temperature reaches a maximum represented by the boiling point of water under local conditions, the flow may take the form of periodical eruptions, the spring being known as a geyser. See SPRING.

**THERMAL UNIT**, or HEAT UNIT, the quantity of heat required to raise a specific amount of water, as a standard substance for measurement, through one degree of temperature. "CALORIE; FUEL; HEAT.

**THERMIDOR**. ("Hot Month"). The eleventh month in the calendar of the first French Republic, from July 19 to August 18. The ninth Thermidor of the Republican year 2 (July 27, 1794) is memorable as the date of Robespierre's fall, and the termination of the Reign of Terror.

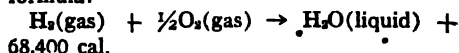
**THERMOCHEMISTRY**, the division of the science of chemistry treating of the energy phenomena involved in chemical reactions. Nearly all chemical reactions are accompanied by energy changes which are usually in the form of heat transfers. Most of these reactions result in heat energy being liberated, and are said to be *exothermic*. Thus the burning of coke, in which solid carbon and gaseous oxygen from the air unite to produce carbon dioxide, is an exothermic reaction which results in the release of heat. Thermochemistry also includes those changes in

which energy is liberated in forms other than heat, such as light and electrical energy. Other reactions may occur in which heat is absorbed rather than released, i.e., heat, or energy in some other form, disappears during the reaction. Reactions of this type, which absorb heat or other types of energy, are called *endothermic*. Melting of ice is an endothermic reaction in which heat is absorbed from the surrounding air, thereby lowering the air temperature. Similarly, hydrated sodium thiosulfate, dissolved in water at room temperature, produces a solution which is cooler than the original water; the heat lost by the water is necessary to dissolution of the solid.

Energy produced by a chemical change, either in the form of liberated or absorbed heat, may be accurately measured by performing the reaction in an instrument called a calorimeter; see CALORIMETRY. A specific name is applied to the energy absorbed or emitted, according to the type of reaction with which it is associated. Thus, the heat absorbed or given off when a unit of solute is dissolved in a unit of solvent is called the *heat of solution*. Other terms include: *heat of combustion*, which is produced by the burning of a substance in air, *heat of formation*, utilized or emitted in the process of a chemical combination by which a distinct compound is formed, *heat of solidification*, produced by the transformation of a liquid or gas into the solid state; *heat of condensation*, released by the return of a gas to the liquid state, and *heat of hydration*, given off or absorbed when a substance combines with water. Except in atomic reactions (see ATOMIC ENERGY AND ATOMIC BOMB), the energy produced by chemical reactions in the form of heat loss or gain can neither disappear nor be destroyed, but may be converted into other forms. For example, a steam engine may convert heat energy to mechanical energy, and the mechanical energy may be converted by a generator into electrical energy. Similarly, in reversible chemical reactions (see CHEMISTRY), the amount of heat liberated by the exothermic process in one direction will be equal to the amount absorbed by the endothermic reaction in the reverse direction.

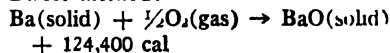
In order to express the energy change which has been observed and calculated experimentally, various forms of chemical equations have been utilized. These equations, in addition to indicating the substances involved, must also take into account the

physical state of the reaction substance. For example, a reaction in which 68,400 calories of heat are liberated when one gram molecule of hydrogen gas reacts with one-half gram molecule of oxygen gas to produce one gram molecule of liquid water is expressed by the formula:

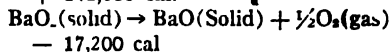
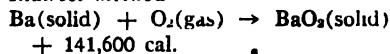


Some chemical reactions take place in several steps, each step absorbing or freeing varying amounts of energy. However, the total quantity of energy involved in a reaction depends only on the initial and final substances and conditions, and is not affected by any intermediate phenomena. This general principle, commonly referred to as the law of constant heat summation, was originated in 1840 by the French chemist Germain Henri Hess. It may be illustrated by the two different methods of chemical reaction which result in the preparation of barium oxide, BaO

(1) *Direct method:*



(2) *Indirect method*



The amount of heat energy liberated by the solid barium is therefore the same in the direct method (124,400 cal) as in the indirect (141,600 + 17,200 = 124,400). With a knowledge of the various intermediate steps involved in chemical reactions, it is possible, through the law of constant heat summation, to predict accurately the heat of reaction of any process not measurable by physical means; see THERMODYNAMICS.

**THERMODYNAMICS**, the branch of physical science which deals with the relation between heat and work. It forms the basis of the modern doctrine of energy, and the science of applying mechanics to heat phenomena. With the development of the theory, the names of Colding, Hirn, Davy, Rumford, Joule, and Mayer are closely associated. In 1843 Joule obtained a measurement of the mechanical or dynamical equivalent of heat, commonly called Joule's Equivalent. By demonstrating that wherever energy in the dynamical form is lost an exact equivalent of heat is always obtained, Joule established what is known as the First Law of Thermodynamics. Briefly, this law is the statement that heat is energy, and can be measured in the same units.

Others who developed the science, which embraces the functions of steam engines, gas engines, and all machines which do work by combustion of fuel, were Carnot, Rankin, Clausius, and Thomson (Lord Kelvin). Sadi Carnot, in his *Réflexions sur la Puissance du Feu* (1824), laid down the lines along which the complete theory must be developed. His own argument was vitiated by the assumption of the then accepted caloric theory of heat. But we know from his posthumous papers, published in 1878, that Carnot, before 1832, recognized that heat was energy, and had fully enunciated the First Law of Thermodynamics.

The novel feature of Carnot's method was the invention of the cycle of operations, and especially the reversible cycle. An engine or working substance will have passed through a cycle of operations when all its parts have recovered exactly those physical conditions (volume, pressure, temperature, and the like) which they had at the beginning. It is only when such a cycle has been completed that we have the right to reason about the equivalence of the transformations of energy which have taken place during the progress of the operations which constitute the cycle.

The perfect or reversible engine, as imagined by Carnot, is capable of going through a cycle of operations in either direction. During the direct process, the heat engine does work at the expense of an equivalent amount of heat which disappears; during the reverse process the heat is restored at the expense of an equivalent amount of work done on the engine. On account of the tendency of heat to diffuse in the direction of diminishing temperature, this condition of things cannot be practically realized; but as the temperature differences become smaller and smaller, the conditions for true reversibility become more and more closely approximated. If there were available an absolute nonconductor of heat, we should be able to study transformations without gain or loss of heat to the working substance. Under such *adiabatic* conditions, as they are called, reversibility would be realizable.

A valuable deduction from Carnot's principle was made by Thomson (Lord Kelvin), who defined temperature in a manner quite independent of the properties of any particular substance. So defined, it is known as the absolute temperature. The greatest possible efficiency of a heat engine is measured by the ratio of the difference of temperatures of the source and refrigerator to the temperature of

the source. This absolute scale is found to be in close accordance with the scale of the air thermometer; and its zero, as determined by Lord Kelvin and Joule, lies  $274^{\circ}$  centigrade below the freezing point of water. Thus a perfect engine working between temperatures  $0^{\circ}$  to  $1^{\circ}$  C. would have an efficiency of a little more than one fourth. Practically, it will hardly exceed half that value.

When a substance takes in or gives out heat it is said to change its *entropy*, an index of the relative amount of unavailable energy in a physiochemical system: the length on a diagram in which area is energy, in heat units, and height is absolute temperature.

**THERMOELECTRICITY**, electricity generated by difference of temperature, as by two different metals in double contact and at different temperatures; also, that part of the science of electricity embracing phenomena related to the resistance caused by passage of a current in a conductor, developing heat or light. See **ELECTRICITY**.

**THERMOGRAPH**, a registering thermometer. It is a mercurial thermometer of which the successive positions of the column are photographed on a traveling strip, or a metallic or a gas thermometer, fitted with multiplying levers and a tracing point, as used in aeronautics.

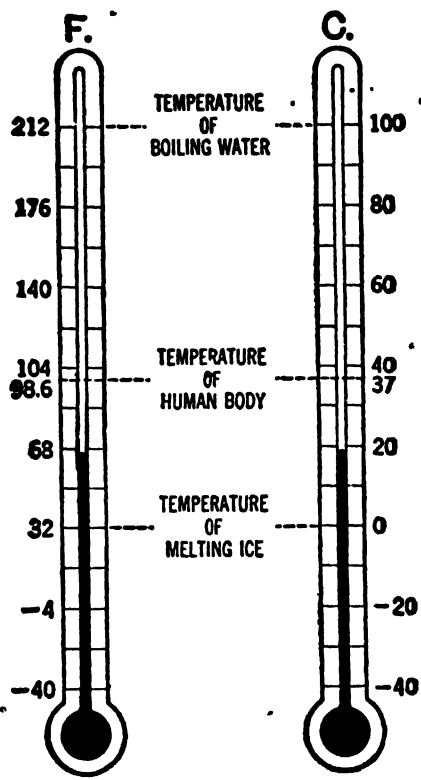
**THERMOMETER**, an instrument for measuring temperature. The ordinary thermometer consists of a glass tube of narrow bore, which opens into a bulb at one end. The bulb and part of the capillary tube are filled with a substance, generally mercury, sometimes alcohol or other liquid. Mercury is pre-eminently suitable for thermometric purposes. It remains liquid through a long range of temperature; expands regularly as heat is applied to it; it is opaque, and therefore easily read; and does not wet the surface of the glass with which it is in contact. For low temperatures alcohol and other thermometers are valuable, these substances having a low freezing point and a high expansibility.

The two standard temperatures universally used in graduating a thermometer are the freezing and boiling points of water. In the modern centigrade, or Celsius, scale, the freezing point of water is taken at zero, and the boiling point under a pressure of 760 millimeters (29.92 in.) of mercury as  $100^{\circ}$ . In the Fahrenheit thermometer, the freezing point of water is  $32^{\circ}$  and its boiling point  $212^{\circ}$ .

Réaumur divided the interval between the freezing and boiling points into eighty

divisions, and his scale is still largely used.

The centigrade scale is used almost exclusively for scientific purposes. British and American meteorologists, however, prefer the Fahrenheit scale, which has two distinct merits as compared with the centigrade. Its



*Fahrenheit (left) and centigrade thermometers*

degree is smaller, so that, reading to tenths, it is a more delicate instrument; and the freezing point being at 32°, it is only under severe wintry conditions that negative temperatures are found.

Various modified forms of thermometers are used for particular purposes.

**Maximum and minimum** thermometers belong to the self-registering class of instrument. In one form of maximum thermometer the mercury pushes a small index, which remains to show the highest point reached. In the minimum thermometer, the index is set in the alcohol used as the thermometric substance. As the alcohol contracts, it drags with it the index, and its upper end indicates the lowest point reached by the curved capillary surface of the liquid.

**Clinical thermometers** are small instruments specially designed for determining the body temperatures of animals (mouth or rectum). They are self-registering, usually by a trap in the capillary tube between the bulb and the lowest graduation on the scale, of the correct size, so that the mercury can expand through the trap in fine globules, but cannot flow back. From one-half to three minutes are required to obtain the final temperature indication when placed in the mouth, and before the thermometer is used again the mercury column must be shaken down into the bulb. To avoid the objection that the graduations may retain disease germs not readily removable by antiseptic liquids, clinical thermometers are sometimes made with the scale inclosed in a glass tube, or the thermometer completely covered by a thin glass envelope.

For continuous registration of temperature, or for self-registration of temperatures at short intervals, intermittent photography is used.

Historically older than and scientifically superior to the mercurial thermometer is the *air* thermometer. It is indispensable for measuring the very low temperatures that must be reached before the ordinary gases can be liquefied under great pressure.

Thermoelectricity has provided delicate methods of measuring the most minute changes of temperature. See PYROMETRY.

The invention of the thermometer must be attributed to Galileo, who about the year 1593 made an open-air thermoscope, consisting of a bulb with a long tube attached, which was provided with a scale and dipped below the surface of a liquid, water or wine. Some of the air was expelled from the bulb, and so the liquid rose in the tube. This thermometer was later used (1611) by Sanctoarius in the diagnosis of fevers. The word thermoscope was used by Bianconi in 1617 and thermometer in 1624 by Leurechon. The first scaled thermometers were those of Ferdinand II, Grand Duke of Tuscany (1641). They contained alcohol. In 1661 Fabri made a scale, using as the fixed temperatures those of snow and of midsummer heat. Robert Hooke in 1664 proposed the freezing point of water as one of the fixed temperatures; and in 1694 Renaldini proposed this as one, and the boiling point of water as the other. In 1709 Fahrenheit introduced his alcohol thermometers, and in 1714 his mercury ones. About 1731 Réaumur devised his scale, which until recently was in extensive use on the



continent of Europe. In 1742 Celsius proposed a centigrade scale, with the temperatures of melting ice  $100^{\circ}$  and boiling water  $0^{\circ}$ . Christin, working independently of Celsius, proposed a centigrade scale in 1743 which is the Celsius scale inverted, and is the one used now.

**THERMOPYLÆ** (Gr., "Hot Gates"), a pass famous in ancient Greek history, lying between Mount Cēta and the Maliac Gulf and leading from Thessaly into Locris. The pass, which received its name from the existence of several hot sulphur springs in the vicinity, was the main route by which an invading army could penetrate from northern into southern Greece. In ancient times it was a narrow track about fifty ft. wide passing under a cliff, but alluvial deposits have so altered the coast line that it is now a broad swampy plain from one and a half to three miles broad. Thermopylæ won eternal fame as the scene of the heroic death of Leonidas I (q.v.) and his 300 Spartans in their attempt to stem the tide of Persian invasion in 480 B.C. The Spartans were betrayed by Ephialtes, a Thessalian, into the hands of the Persians, who, by following a path over the mountain, attacked the Greeks from the rear. In 279 B.C. Brennus, at the head of a Gallic force, traveled the same path and forced the united Greeks to withdraw from the pass. Again, in 191 B.C., Antiochus III (q.v.), King of Syria, endeavored to check the Romans at this point, but Marcus Porcius Cato stormed the fortress which commanded the path, and, aided by a frontal attack of the main Roman force under Manius Acilius Glabrio, routed and almost annihilated the Syrian army.

**THERMOSTAT**, an automatic device employed to maintain or regulate the temperature of an enclosed area by controlling the operation of a heat-producing apparatus. Nearly all thermostats are operated by the expansion of liquids or solids subjected to varying degrees of heat. Thus, in a typical metallic-element thermostat, two metals, such as steel and bronze, having different coefficients of expansion, are fastened together and arranged in a spiral or as a straight rod. The metal spiral or rod is then securely attached at one end to a fixed point, the other end being fastened to a pointer or indicator. When the temperature of the surrounding atmosphere rises above a predetermined point, the unequal expansions of the two metals force the coiled or rod-shaped strip to bend the pointer toward one of the contacts, automatically causing the heating unit to cease

functioning temporarily. Similarly, a drop in temperature below that desired will force the strip and the indicator in the reverse direction and against the opposite contact, thereby causing the heating unit to function until the pointer returns to its neutral position.

The wafer-type thermostat, constructed of numerous flat, circular shells called sylphons, operates on the principle of the expansion of liquids when heated. The pressure resulting from water heated within this form of thermostat is exerted upon the walls of the very flexible sylphons, causing an undulating motion which is in turn transmitted to the valves regulating the operation of a heating system. Other types of thermostats, used in more specialized cases, may be operated by the action of electric currents, or may depend upon the varying resistances of metallic conductors. The principle of the thermostat is also used to put out fires in houses and factories by setting automatic sprinkler systems into operation.

**THEROIGNE DE MÉRICOURT** (1762-97), a prominent figure during the French Revolution, born in Marcourt, near Liège, as Anne Joséphe Terwagne. Knowing all the leaders of the Revolution, she became an enthusiastic Republican and the commander of the mobs of women that played such a conspicuous part in the dramatic days of the Revolution. Armed with sabre and pistol, she led her feminine battalions against the Bastille, July 14, 1789, and to Versailles on October 5-6 of the same year, and after her return from an Austrian prison was prominent during the disturbances on June 20 and Aug. 10, 1793. In May, 1793, while defending her lover, a Girondist, she was seized, stripped, and whipped by a mob of mad-dened women. She became insane from this treatment, and spent the rest of her life in the asylum at La Salpêtrière.

**THEROMORPHA**, an extinct order of synaptosaurian reptiles, especially those without paroccipital bones, and with ribs mostly two headed and capitulum intercentral. See DICYNODON.

**THERSITES**, in Greek legend, a Greek warrior, son of Agrius, who fought in the Trojan War. Homer in his *Iliad* describes him as the ugliest and the most impudent of the Greeks massed before Troy. After the withdrawal of the hero Achilles (q.v.) from the fighting, Thersites reviled Agamemnon (q.v.), the commander in chief of the Greek forces, and was beaten by the hero Ulysses, to the

amusement of the assembled Greeks. According to later writers, he mocked Achilles for mourning the death of Penthesilea (q.v.), Queen of the Amazons, and was slain by Achilles.

**THESEUS**, the great national hero of the ancient Athenians, and, next to Hercules, the most famous character of Greek legend. He was said to be the son of Ægeus (q.v.), King of Athens, and Æthra, daughter of King Pittheus of Troezen, but early legend also recognized the paternity of Poseidon, god of the sea; modern writers suggest that Ægeus was originally a local name of the sea god.



*Theseus slaying a Centaur (Greek painting)*

Theseus, having grown to maturity in Troezen, set out for Athens with the sword and sandals left behind by Ægeus. On this journey he killed many dangerous men and beasts, his adventures recalling the more illustrious exploits of Hercules; Theseus slew, among others, the brigands Sinis, Procrustes, and Sciron (qq.v.). Arriving at Athens, Theseus narrowly escaped poisoning at the hands of the sorceress Medea (q.v.), who, after her crimes at Corinth, had sought refuge with Ægeus in Athens. Ægeus, recognizing the sword and sandals as his own, acknowledged the youth as his son. Theseus next captured the fire-breathing bull of Marathon, which had been brought from Crete by Hercules. Then came the famous expedition to Crete to deliver Athens from the necessity of paying human tribute to the monstrous Minotaur (q.v.); this creature Theseus killed with the assistance of Ariadne (q.v.), the daughter of King Minos, whom he took from

Crete but later deserted, on the island of Naxos. On his way home from Crete he founded a festival at Delos in honor of the god Apollo, and to this shrine the Athenians thereafter sent an annual embassy. Theseus, on setting out from Athens with black sails, as was customary for the ships which bore the Athenian youths and maidens to the Cretan sacrifice, had promised to change the sails from black to white if he returned in safety; he forgot the promise, however, and Ægeus, seeing the black-sailed ship returning and believing that his son had perished, hurled himself from a rock into the sea.

Theseus now became king of Athens. He took part in several legendary expeditions, including that of the Argonauts (q.v.), the Calydonian hunt (see CALYDONIAN BOAR; MELEAGER), and that against the Amazons (q.v.). As a result of this last trip, the Amazons invaded Attica, but were finally repulsed by Theseus, who secured as wife their queen, Antiope or Hippolyta (q.v.), by whom he had a son, Hippolytus (q.v.). After the death of his wife, Theseus married Phædra (q.v.), the daughter of Minos and sister of Ariadne. Having formed a firm friendship with Pirithous (q.v.), King of the Lapithæ, he aided the latter in his fight against the Centaurs; with the assistance of Pirithous, he later carried off Helen, (see HELEN OF TROY) from Sparta, but she was subsequently rescued by her brothers Castor and Pollux. Theseus also accompanied Pirithous to the lower world when the latter desired to carry off Persephone (q.v.) as his bride, but both heroes were imprisoned in the underworld; Pirithous never returned, and Theseus remained in captivity until Hercules, on his quest for Cerberus, prevailed upon Hades to release him. During Theseus' absence from Athens, his wife Phædra fell in love with Hippolytus, her stepson, and, being repulsed by the youth, committed suicide, leaving a false accusation against Hippolytus. Theseus returned from the underworld and, believing the charge, cursed his son, who was later dragged to his death, the curse being fulfilled by the god Poseidon. Theseus was unable to re-establish his authority after his return to Athens and went to the island of Scyros (q.v.), where he was murdered by King Lycomedes.

Although most of the tales concerning Theseus seem pure myth, the ancient Athenians themselves looked upon him as a historical figure, one of their early kings, to whom was attributed the consolidation into

one state of the twelve independent communities of Attica. In celebration of this event the festival of the Panathenæa (q.v.) was instituted.

**THESPESIOS**, former name for the *Clasaurus*, a genus of large Cretaceous saurians, related to the *iguanodon*, one species of which attained a length of nearly 30 feet.

**THESPIÆ**, a town in ancient Bœotia, near the foot of Mount Helicon. Like Plataea (q.v.), it was hostile to the Theban pretension to supremacy in Bœotia (see **THEBES**), and these two were the only Bœotian cities which refused to give earth and water to the heralds of Xerxes and to side with the Persians at the battle of Salamis. Seven hundred Thespians joined Leonidas at Thermopylae (q.v.), and were slain in defending the pass. Thespiæ was burned by Xerxes, but was subsequently rebuilt. Shortly after the battle of Leuctra (371 B.C.) it was again destroyed, and was afterward a second time restored. Here was preserved a marble statue of Eros by Praxiteles (q.v.). Because of the proximity of Mount Helicon, the Muses were called *Thespiads*.

**THESPIS** (fl. 6th century B.C.), Athenian poet, known as the father of Greek tragedy. His first victory in a dramatic contest is said to have been about 534 B.C. To him was attributed the introduction of an actor to converse with the leader of the chorus, who previously had recited the adventures of the god Dionysus (q.v.) to the chorus and had been answered by the chorus. Originally only the chorus and its leader were on stage. Thespis' introduction of an actor to respond to and interrupt the leader's exposition represents the beginning of dialogue in Greek drama. Thespis is also said to have introduced the use of a linen mask, which made possible more dramatic action, because the actor, by disguising himself, could represent various characters in the same play.

**THESPI: OR THE GODS GROWN OLD**, comic opera in two acts by the English composer Sir Arthur Sullivan with a libretto by the English writer Sir William Gilbert, first presented in London on December 23, 1871. The scene of Act One is a ruined temple of the gods on Mount Olympus. The gods and goddesses, well on in years, lament their age and the decline of their influence on earth, as evidenced by the decrease in sacrifices and votive offerings. Mercury announces the approach of a group of mortals. As the gods conceal themselves in the temple, Sparkieon and Nicemis, a pair of lovers, enter. This is

to be their wedding day, celebrated in picnic style by the Thespians, a troupe of strolling actors and actresses. Their leader Thespis is complaining of his lot as manager of the revelers when the gods, in full Olympian costume, confront the group and challenge their presence. Then Jupiter relaxes slightly and requests Thespis' opinion of the gods' appearance and their general status on earth. Thespis frankly criticizes them as being behind the times. He suggests they descend to earth incognito to mingle with the people and thus discover the best means of restoring their influence. The gods decide to do so, and Thespis and his company remain in charge of Olympus, each of the Thespians assuming the character of a god or goddess. Mercury is left behind as consultant in case of difficulty.

Act Two, which takes place a year later, finds Mercury amused by the youthful activities of the substitute gods and goddesses. Thespis is smugly satisfied with the ease with which affairs have been discharged, and is shocked to learn that while Mercury has been tolerant of their errors, he has adhered to duty—that of collecting all complaints addressed by mortals to Jupiter. Mercury bids Thespis summon the court to hear the accumulated complaints. Meanwhile, Sparkieon, as Apollo, is in a delicate situation because Nicemis and Daphne each claim he is her husband. Reference to the *Olympian Peerage* does little to clear the confusion. At this point the real gods return to Olympus. Jupiter is incensed to learn that Thespis has not been consulting Mercury. The gods attend the hearing of the mortals' petitions against the ongoing experiments of the Thespians. Jupiter summarily ends their reign on Olympus, and condemns them henceforth to be eminent tragedians.

**THESSALONIANS, FIRST AND SECOND EPISTLES TO THE**. The first epistle, which is the earliest extant epistle of Paul, was written at Corinth, about 53 A.D. or 54 A.D. Of its two parts the first is mainly personal and explanatory (1-3), and the second ethical and doctrinal (4, 5). Buar, who was the first to deny the genuineness of this epistle, has not been followed in this by the more recent representatives of the Tübingen school.

The second epistle consists of three parts. The first is introductory (1:1-12). The second (2:1-12) is eschatological, and warns readers against supposing "that the day of the Lord is now present". The concluding part of the epistle (2:13-3:18) substantially repeats the

Exhortations of 1 Thessalonians. The genuineness of this epistle was first doubted by J.E.C. Schmidt (1801), which doubt has steadily increased since that time. Assuming the hypothesis of its genuineness, 2 Thessalonians must have been written shortly after 1 Thessalonians and before the apostle's sojourn of eighteen months in Corinth had come to an end. Apart indeed from 2:1-12, 2 Thessalonians may conceivably have been written before 1 Thessalonians.

**THESSALONICA.** See SALONIKI.

**THESSALY**, the largest division of ancient Greece, a vast plain, separated on the n. from Macedonia by the Cambunian Mountains, on the w. from Epirus by the Pindus range, and on the s. from Locris and Phocis by the Maliac Gulf. The Ægean Sea is on the e. The plain is drained chiefly by the Salambría (anc. Peneus) River and its tributaries, and is the most fertile in all Greece; the river flows into the sea through the famous vale of Tempe (q.v.), between mounts Olympus and Ossa. In ancient times the plain produced an abundance of grain and cattle, and a breed of horses considered the finest in Greece. In Greek mythology, Thessaly was the home of the Centaurs and the Lapithæ (qq.v.), and from Thessaly Jason and the Argonauts (q.v.) set out in quest of the golden fleece.

The government of Thessaly in the early historical period appears to have been oligarchical in the separate cities, of which Pharsalus, Larissa, Heracleum, and Pheræ were the most important; during the 6th and 5th centuries B.C. the principal power was in the hands of the two families of the Aleuadæ of Larissa and the Scopadæ of Crannon and Pharsalus. About 374 B.C. Jason, tyrant of Pheræ, was elected *tagus*, or chief magistrate, of all Thessaly. The rule of Jason's successors became so unbearable that aid was sought from Philip of Macedon, who in 344 B.C. subjugated the country. Thessaly remained subject to the Macedonian kings until the victory of Titus Quinctius Flamininus at Cynoscephalæ in 197 B.C. brought it under the protection of Rome. Under the Roman emperors Thessaly was united with Macedonia, but after the reign of the emperor Constantine (306-37 A.D.) it became a separate province. In 1204 A.D., along with other portions of the eastern empire, Thessaly came under the dominion of the Venetians, and in 1335 was taken by the Turks. Turkey ceded Thessaly to Greece in 1881, as a result of the Congress of Berlin (1878) which

followed the Russo-Turkish War. In 1897 Thessaly was the principal battleground of the Greco-Turkish War.

Today the plain of ancient Thessaly, over 5000 sq.m. in area, comprises the Greek departments of Larissa and Trikala, with a population of nearly 500,000. The region is essentially agricultural and pastoral.

**THETFORD MINES**, town of Wolfe Co., Quebec, 80 miles s.w. of Quebec. It has extensive asbestos mines. Pop., about 10,000.

**THETIS**, in Greek mythology, the daughter of the sea divinities Nereus and Doris (qq.v.), and the most famous of the Nereids (q.v.). She was wooed both by Zeus, father of the gods, and by Poseidon, god of the sea, until they learned the prophecy that she would bear a son who would be mightier than his father; thereupon she was forced against her will to marry a mortal, Peleus (q.v.), the ruler of the Myrmidons. At the marriage of Peleus and Thetis, Eris (q.v.), goddess of discord, threw a golden apple, inscribed "To the Most Beautiful", among the assembled guests; the resultant strife among the three goddesses Hera, wife of Zeus, Athena, goddess of wisdom, and Aphrodite, goddess of love, led ultimately to the Trojan War (see PARIS). By Peleus, Thetis became the mother of the hero Achilles (q.v.). She lived in the depths of the sea with her father, and had, like Proteus (q.v.), the power of changing her shape.

**THEURIET**, ANDRÉ (1833-1907), French poet and novelist, born in Marly le Roi, near Paris. His poems include *Revue des Deux Mondes*; *Le Chemin des Bois*, a volume of woodland poems; *Les Paysans de l'Argonne*; and *Le Bleu et le Noir*. His novels include *Mademoiselle Guignon* (1872), *Le Mariage de Gérard*, *Une Ondine* (1875), and *Flavie* (1895).

**THÉVENET**, MARIUS (1845-1910), French politician, born in Lyons. He studied law and gained great distinction at the bar of his native city, and was elected a deputy from the department of the Rhône in 1885. He was appointed minister of justice and public worship in 1889. Thévenet displayed great activity in this position in the suppression of Boulangism, and vigorously prosecuted the French writer and politician Paul Déroulède as chief of the League of Patriots. He was re-elected deputy in 1889, lost his portfolio at the fall of the ministry in 1890, and in 1892 was elected senator from the department of the Rhône. Thévenet's militant attitude in

the Dreyfus affair caused him to fail of reelection to the Senate in 1900.

**THIAKI.** See **ITHIACA**.

**THIAUMONT**, a defensive work in the Verdun area of France in World War I, regarded as a key to the whole position. French infantry defended Thiaumont in July, 1916, with great determination in the face of a German bombardment which, in one instance, literally buried alive in their trenches nearly two entire battalions. "La Tranchée des Baïonnettes" (The Trench of the Bayonets) is preserved untouched, the muzzles of the rifles of the dead protruding above the level of the ground. The Germans captured Thiaumont, June 23, and retained it until Nov. 1, 1916.

**THIBAUDEAU**, COUNT ANTOINE CLAIRE (1765-1854), French statesman and historian, born in Poitiers. At the outbreak of the French Revolution he was a lawyer in his native city. He was elected to the Convention in 1792, joined the party of the Mountain, and voted for the death of King Louis XVI. In 1793 he was chosen president of the Council of Five Hundred. Thibaudreau abandoned his extreme views, opposed the *coup* of the 18th Fructidor (September 4, 1797), and was saved from deportation by the intervention of friends. After the *coup* of the 18th Brumaire (November 9, 1799) he was made prefect of Bordeaux, and held the position of counselor of state till 1808. In that year he became prefect of the department of Bouches-du-Rhône. He helped in the compilation of the Napoleonic Code and was made count of the empire in 1809. On the second return of the Bourbons Thibaudreau was proscribed as a regicide and lived abroad till the revolution of 1830. He was made a senator by Emperor Napoleon III. He wrote *Mémoires sur la Convention et le Directoire* (1824), *Mémoires sur le Consulat* (1827), *Histoire Générale de Napoléon Bonaparte* (1828), *Le Consulat et l'Empire* (1835), and *Histoire des États Généraux et des Institutions Représentatives en France* (1843).

**THIBAUT**, JACQUES ANATOLE. See **FRANÇOIS ANATOLE**.

**THIBODAUX**, the capital of Lafourche Parish, La., 46 miles w. of New Orleans. The chief industries are fruit canning and sugar manufacture, and a trade in cotton, rice, and sugar cane is carried on. Pop. (1950) 7730.

**THICKET**, a thick growth of underbrush through which a passage is not easily affected. In regions of great rainfall thickets may be regarded as forerunners of forests, but in

many arid regions, while present conditions remain, they are usually the ultimate type of vegetation. Various names have been given to the xerophytic thicket areas. In the southwestern United States they are called chaparral; in the Mediterranean region, maqui; in southern South America, espinal; in Australia, scrub.

**THICKHEAD FLY**, common name for any of the flies of the family Conopidae, a group comprising species with large heads broader than the thorax. They are rather large insects, but are generally slender and with a stalked abdomen. They frequent flowers, and their larvae are parasitic, chiefly upon bumblebees and wasps, and, more rarely, upon grasshoppers. About 30 species are found in the United States.

**THICK-KNEE** (*Oedicnemus*), a genus of birds of the family Otididae. In habits and habits they resemble the bustards. They are partly nocturnal. There are eleven species, widely distributed, but absent from North America.

**THIEF RIVER FALLS**, county seat of Pennington Co., Minn., situated on Thief R. at its confluence with Red Lake R., about 305 miles n.w. of Minneapolis. It maintains a municipal airport, is served by two railroads, and is a railroad division point. The city is the trading, distributing, and shipping center of a rich agricultural area. Dairy products, poultry, seed, and small grains are the chief products of the region. Industries in the city are the processing of dairy products and poultry. In the vicinity of Thief River Falls is Mud Lake National Wildlife Refuge, covering an area of more than 60,000 acres. The city was founded in 1879. Pop. (1950) 6926.

**THIELMANN**, BARON JOHANN ADOLF (1765-1824), Prussian general, born in Dresden. He entered a Saxon regiment in 1782, served through the Rhine campaigns in the French Revolutionary Wars, and fought for Prussia in the battle of Jena in 1806. He was next sent by Saxony as ambassador to Napoleon I, became his ardent admirer, and did much to bring about the Franco-Saxon alliance. He served with the French as major in the campaign of 1807, fought at Friedland in that year, was made major general, and operated against the Austrians in Saxony. In the Russian campaign of 1812 he commanded a brigade of cavalry and for exceptional bravery in the battle of Borodino was elevated to the peerage. As commander of Torgau in the early part of 1813 he entered

into communications with the allies, and on being ordered by the Saxon king to deliver the town to the French, resigned his post and went over to the enemy. He was given command of a Saxon corps which participated in the invasion of France in 1814. He next joined the Prussian army (1815), and led the Third Army Corps at Ligny and at Wavre, contributing materially to the victory at Waterloo.

**THIERRY, JACQUES NICOLAS AUGUSTIN** (1795-1856), French historian, born in Blois. In 1814 he joined the ranks of the Parisian Liberals. Soon after appeared his first book, entitled *De la Réorganisation de la Société Européenne*. In 1820 he contributed *Lettres sur l'Histoire de France* to the *Courrier Français*. In 1825 he published his masterpiece, *L'Histoire de la Conquête d'Angleterre par les Normands*.

**THIERS**, a town in the French department of Puy-de-Dôme, 20 miles E. of Clermont. It is noted for its cutlery. Pop. (1946) 15,409.

**THIERS, LOUIS ADOLPHE** (1797-1877), French historian and politician, born in Marseilles. His articles in *Constitutionnel* on political and literary subjects gained influence for him. In 1830, he, with Carrel, Mignet, and others, started the *National*, and in it combated the Polignac administration. The ministry met the opposition by the Ordinances of July. The result was the revolution which drove Charles X into exile.

Thiers was elected a deputy; appointed secretary general to the minister of finance; and passed through several cabinet offices on his way to the premiership, which he attained in 1836. In August of the same year he resigned and became the leader of the opposition. In 1840 he was again summoned to office as president of the Council and foreign minister. In a few months he was a terror to the peace of Europe. He talked menacingly of setting aside the treaties of 1815 and of extending the French frontier to the Rhine. On his application to the British government, Napoleon's remains were removed from St. Helena to the Invalides (1840). After the *coup d'état* of 1851 he was arrested, and banished for several months.

The collapse of the Second Empire enabled Thiers to play the greatest of his parts, that of "liberator of the territory". He made an abortive diplomatic mission, after Sedan, to procure the intervention of the Great Powers, but was instrumental in securing for his country an armistice which permitted the holding of a national assembly with a view

to the negotiation of peace. He was placed at the head of the provisional government, and was elected (1871) president of the French Republic. He held office till 1873, and was instrumental in securing the withdrawal of the Germans from France, and the payment of the war indemnity. His histories are eulogies of revolutionary and Napoleonic ideals.

**THIERSCH, KARL** (1822-95), German surgeon, born in Munich, the son of the philologist Friedrich Thiersch (1784-1860), and educated at the universities of Munich, Berlin, Vienna, and Paris. In 1854 he became professor of surgery at Erlangen and in 1867 at Leipzig. During the Franco-German War of 1870-71 he served as consulting surgeon in the Prussian army. Thiersch is known through his work in skin grafting and in epithelial cancer. Moreover, he was one of the first Continental surgeons to accept the teachings of the English hygienist Joseph Lister, and with others he introduced the use of salicylic acid in the treatment of wounds. Among his works is *Der Epithelialkrebs Namentlich der Haut* (1865).

**THIETMAR** (975 or 976-1018), German chronicler of aristocratic family, related to Emperor Henry II. Thietmar was educated in the cloister schools at Quedlinburg and Magdeburg, was created in 1002 provost of Walbeck, shared in the campaign of 1007 against Boleslav of Poland, and in 1009 was made bishop of Merseburg. He passed the remainder of his life for the greater part at court and sharing in campaigns against the Slavs. His *Chronicon* covers in eight books the period from Henry I (the Fowler) to 1018, and the last three books are almost a diary. It is rough and inflated in diction and credulous in narration, but shows an earnest search for truth, and is the principal source of history for the Trans-Elbian Slavic districts during the period it covers.

**THIGH**, the portion of the lower extremity which extends from the hip to the knee. The muscles of the front of the thigh are tensor fasciae femoris, sartorius, and quadriceps extensor, the last of which is a powerful group of four muscles which are inserted below into the patella, or kneecap, and whose action is to strengthen the knee. The muscles of the back of the thigh are biceps, semitendinosus, and semimembranosus, also called the hamstring muscles. Their action is to flex the leg on the thigh, to support the pelvis upon the head of the femur, or thigh bone, and to draw the trunk backward. On the inner side of each thigh is a

group of abductor muscles, whose action is to bring the knees together. There is but one bone in the thigh, the femur, which articulates with the pelvis above and with the tibia below.

**THIGMOTROPISM.** See TROPISM.

**THILLY,** FRANK (1865-1934), American educator, born in Cincinnati, Ohio, and educated at the University of Cincinnati and in Berlin and Heidelberg. After taking professorships at the University of Missouri (1893-1904) and at Princeton (1904-06), he became professor of philosophy at Cornell University, where from 1915 to 1921 he was also dean of the College of Arts and Sciences. His publications include a *History of Philosophy* (1914).

**THIONVILLE** (Ger. *Diedenhofen*), a fortified town of Lorraine, France, 18 miles N. of Metz. It is an important railroad center. Pop., about 14,000.

**THIOPHENE**, a colorless liquid compound ( $C_4H_4S$ ) with an odor resembling benzene, found in coal tar and also made by synthesis. It is the base of an important group of organic compounds.

**THIOSULFURIC ACID**, or HYPOSULFURIC ACID. See SULFURIC ACID; SULFUR.

**THIRD**, in music. See INTERVAL.

**THIRD (COMMUNIST) INTERNATIONAL**, known as the COMINTERN, a world-wide union of communist parties, founded in Moscow in 1919 by the Bolshevik leader Nikolai Lenin (q.v.) and his associates for the purpose of overthrowing all "bourgeois" governments and establishing an international federation of Soviet republics. The First International (see INTERNATIONAL WORKINGMEN'S ASSOCIATION), founded in London in 1864 under the leadership of Karl Marx, was dissolved in 1876. The Second International (q.v.) was founded in Paris in 1889. The formation of the Third International marked the complete break of the communist revolutionary movement from the socialist world organization, the Second International. Of the fifty-one delegates representing eight countries who attended the first congress of the new organization, the majority were members of the Russian Communist Party, which had issued the invitation to the meeting. Most of the other delegates represented various groups which had previously constituted a dissident left wing in the Second International, opposing the patriotic support given by right-wing leaders to their governments during World War I. The congress elected the Russian Bolshevik leader Grigori

Zinoviev (q.v.) first president of the Comintern, proclaimed its dedication to the cause of establishing in all countries a proletarian dictatorship modeled on the Soviet regime, and announced its uncompromising hostility to those who placed patriotism and pacifism before the cause of the revolution.

By 1921 the Third International had grown both numerically and in the consolidation of its policy. Over two hundred delegates attended the second congress held in Moscow in 1920. A twenty-one-point program, the endorsement of which was required for membership, placed paramount emphasis on the revolutionary purpose and disciplinary methods of communism. The second congress issued a formal statement declaring that the world was in a state of "acute civil war", and outlined an attack, not only against capitalism and capitalist governments, but also against all socialists who believed in reformist methods and in political democracy. In order to carry out this attack, the congress demanded that all groups affiliated with the Third International accept the Bolshevik organizational system and the disciplinary leadership of the Russian Bolshevik Party. Provision was made for the creation in each country of an "illegal" (or underground) party, in control of the work of the "legal" (open) party. The illegal parties were charged particularly with the task of carrying on secret propaganda and agitation in the ranks of the army, navy, and police. All national communist parties were commanded to seek control of the labor unions of their respective countries and to convert them into "powerful weapons of the revolution". A Red International of Labor Unions (Profintern) was set up to oppose the socialist Amsterdam International Federation of Trade Unions and to win the adherence of organized workers to the Comintern and its revolutionary aims. The specific means whereby the aims of the Comintern were to be achieved by the communist parties of all nations were described in detail in the program drafted by the congress. Under this program, the world communist movement was pledged to support and aid the "Soviet Republics" (i.e., the U.S.S.R.) in the event of war with other nations.

At the fifth congress of the Comintern, held in Moscow in 1924, a constitution was drawn up setting forth the organizational structure in detail. Nominally, the highest governing body of the Comintern was the world congress of representatives of the

member parties. The congress was to meet biannually; after 1928, however, only one congress convened, namely the seventh congress which met in Moscow in 1945. Between sessions of the congresses, supreme authority was vested in the Executive Committee, which was to meet twice a year. A Presidium composed of about thirty members drawn from the Executive Committee was to meet every two weeks, and to conduct the business of the Executive Committee during the intervals between the latter body's meetings. The Presidium was empowered to elect from among its members a Political Secretariat composed of twelve individuals; the Political Secretariat actually functioned as the highest executive organ of the Comintern, formulating its fundamental strategy and tactics, laying down the "Party line", and exercising effective control over both the Presidium and the Executive Committee. Under the constitution the revolutionary tasks before the Comintern were assigned to various departments, the most important of which were the departments of organizations (Orghuro), of information and statistics, and of propaganda and agitation. The communist parties throughout the world were grouped into a number of geographical sections, such as the Scandinavian and Balkan sections, each directed by a Central Committee controlled by the Executive Committee.

During the 1920's, as the postwar political situation in Europe moved toward stabilization, the prospect of a world-wide civil war receded. Communist uprising in several countries of Europe, notably Germany and Hungary (see *GERMANY: History*; *HUNGARY: History*), were brief and unsuccessful. The newly formed communist parties throughout the world were thrown into confusion by this apparent refutation of the most basic tenets of Marxist theory, and the leaders of the Third International made frequent adjustments and alterations of program and policy. In 1928 a sixth congress held in Moscow emphasized the authoritarian character of the organization and objectives of the Comintern. The new program, drawn up primarily by Joseph Stalin (q.v.), head of the Russian Communist Party and of the Soviet state, reaffirmed the absolute and unqualified dedication of the Third International to world revolution. The disciplinary organization of the national communist parties, which had been established in almost fifty countries, was tightened, and instructions for immediate action and revolutionary propaganda were

more explicitly defined. Considerable emphasis was placed on the duty of all communists throughout the world to defend the U.S.S.R. against military attack by the capitalist powers. After the sixth congress of 1928, the Comintern changed little in organization or policy. From its inception it was a strongly centralized body, denying any autonomy whatever to the separate communist parties of the various nations. Strict party discipline was demanded of all individual members, who were expected to execute promptly the decisions of the Communist International and its various organs, and the active membership had no opportunity to participate in the formulation of party policy.

The Communist International had no formal connection with the Soviet government. The existence, however, of a close bond between the two was evident. The headquarters of the Comintern were located in Moscow, and its financial support came chiefly, although secretly, from the Soviet government. The Soviet Communist Party was always dominant in the International, both in numbers (almost three fourths of the total membership were Soviet communists in 1928) and in the positions of power held by its members. The guiding force of the Comintern was from the beginning the head of the Soviet state, i.e., from 1919 to 1924, Nikolai Lenin, and after 1924, Joseph Stalin.

The program adopted by the sixth congress in 1928 made more stringent the conditions for membership laid down by the second congress in 1920 and extended them to require the subordination of all local interests to the interests which the leading bodies of the Comintern decided should take precedence. That these decisions often reflected internal factional disputes in the Soviet state and the exigencies of Russian foreign policy is indicated by the frequent changes in the policy of the Comintern. Its policy alternated between extreme revolutionism (leftism) and a "united front" with reformist social democrats (rightism), depending on which policy best served the requirements of the U.S.S.R.

After several quick shifts from leftism to rightism in the 1920's, the Comintern made a sharp turn to the left in 1929, and followed this course until 1934. The conditions existing when the turn was made in 1929 were as follows: in the Soviet Union, Joseph Stalin had overcome all factional opposition to his personal power and established himself as undisputed master of the Soviet state and the Soviet Communist Party; the democratic



countries were undergoing a severe depression, with unparalleled unemployment and almost chaotic social dislocation; and in Germany, the National Socialist Party, led by Adolf Hitler (qv.), was plotting the overthrow of the republican government (see NATIONAL SOCIALISM). Among the leaders of the Comintern these conditions were interpreted as the precursors of a new era of revolution. They welcomed Hitler's coming to power in 1933 as a step forward in the destruction of the old order, paving the way for a workers' revolution. Throughout this period, from 1929 to 1934, the Communist International prohibited any co-operation between its members on one hand and democratic socialists and reformist organizations on the other.

The victory of Hitler proved far more substantial than the communist leaders had expected, removing temporarily all hopes of a revolution led by the communists in Germany and also presenting a military threat to the Soviet Union. Alarmed by the growing danger to Soviet security, the Comintern suddenly proclaimed, in February, 1934, a "Popular Front" policy of unity between communists and all who believed in any form of democracy. The basic doctrine of revolution was apparently put aside. For the next five years this policy was maintained, and communists openly entered the governmental and educational services of the democratic states. In August, 1939 the policy of the Comintern turned leftward again when the Soviet Union signed a nonaggression pact with the government of Hitler, presumably for reasons of military strategy, and a few weeks later, upon the outbreak of World War II, joined the Nazis in the invasion and conquest of Poland. The communist parties of all countries were unsparing in their condemnation of the war as an imperialist struggle. When, in June, 1941, Germany invaded the Soviet Union, the Comintern made another extreme rightward swing to a Popular Front with the democracies. In this new stage the continued existence of the Communist International, and its avowed aim of overthrowing the "bourgeois" (i.e., democratic) states, became a strong obstacle to the collaboration of the U.S.S.R. with the democratic powers in their war effort against a common enemy. On May 22, 1943, without any apparent consultation with its member parties, the Executive Committee announced the dissolution of the Communist International, declaring "that the forms, methods,

and regulations of the Comintern had become obsolete".

Four years later, in September, 1947, representatives of the communist parties of nine European countries (Russia, Yugoslavia, France, Italy, Poland, Bulgaria, Czechoslovakia, Hungary, and Romania) met in Poland and announced that a Communist Information Bureau would be established in Belgrade, Yugoslavia, to act as a co-ordinating agency for communist parties. The manifesto issued by the nine parties called for all communist parties to "place themselves in the vanguard of the opposition" to the "expansion and aggression" of the United States "in all spheres (military, strategic, economic, ideological)". The newly formed organization, generally called the Cominform, was regarded by the foreign offices of the Western democracies as a continuation of the Comintern, though Stalin and the other leaders of the Cominform declared the new organization to be fundamentally different in organization and methods from its predecessor. The first internationally important action of the Cominform was its denunciation in June, 1948, of Marshal Tito (qv.), who had acquired considerable personal power as head of the communist government of Yugoslavia. Tito was accused of not conforming to communist doctrine and slandering the Soviet Union. The conflict ended in a complete break between the Soviet Union and Yugoslavia, the expulsion of Tito from the Cominform, and the removal of the headquarters of the Cominform from Belgrade to Bucharest, Romania. The rupture was accepted by most Western governments as convincing proof that the Cominform was an international organization identical in purpose with the Comintern, and was, as the Comintern had been, an instrument of the Soviet Union, dedicated to the revolutionary overthrow of capitalism and the establishment of a proletarian dictatorship throughout the world.

**THIRLMERE**, lake in the English Lake District, lying 533 ft. above sea level. It is 3 m. long by ¼ m. wide, and is situated between Derwentwater and Grasmere.

**THIRLWALL**, CONNOP (1797-1875), English bishop and historian, born in London. He took holy orders in 1827, and in 1834 received the living of Kirby-Underdale. Here he wrote his *History of Greece* (8 vols., 1835-47; improved ed., 1847-52). In 1840 Lord Melbourne raised Thirlwall to the see of St. David's, which he held for thirty-four years. He was appointed chairman of the Old

Testament Revision Committee. Among his notable writings is the series of letters to a young lady, the *Letters to a Friend*, edited by Dean Stanley in 1881; his *Remains, Literary and Theological* (3 vols.) appeared in 1877-78 and an edition of the *Letters, Literary and Theological* in 1881.

**THIRST.** See INANITION.

**THIRTY-NINE ARTICLES.** See ARTICLES, THE THIRTY-NINE.

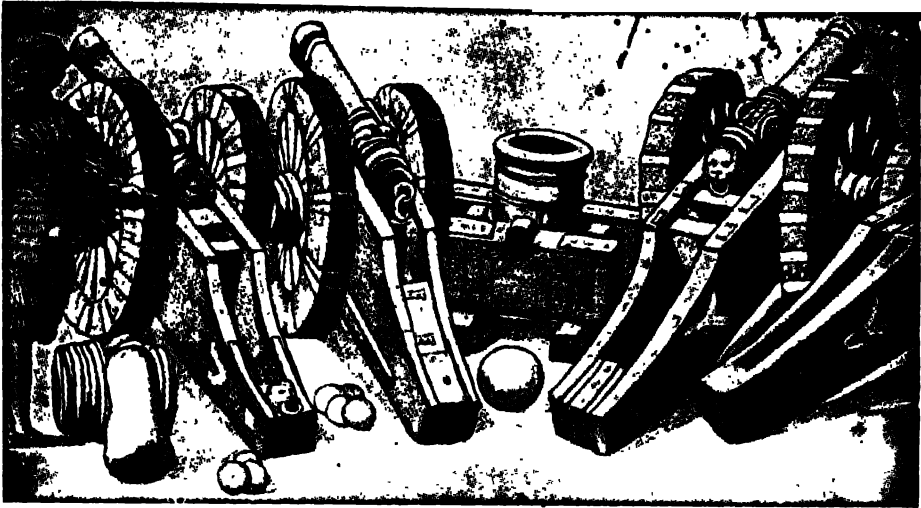
**THIRTY TYRANTS, THE,** two political bodies famous in ancient history. 1. A group of thirty Athenian aristocrats selected by the Spartan conquerors at the end of the Peloponnesian War in 404 B.C., and invested with sovereign power. Through the agency of this oligarchic body Sparta hoped to rule the city. One of the most extreme and unscrupulous members of the group was Critias (q.v.), who had Theramenes (q.v.), the leader of the moderate division, put to death. The rule of the Thirty was overthrown in 403 B.C. by Thrasybulus (q.v.), and the democracy was restored. 2. In Roman history, a body of petty usurpers, actually only nineteen in number but so called in memory of the Athenian tyrants, who tried to seize power and establish themselves as independent princes during the joint reign of the emperors Valerian and Gallienus from 253 to 259 A.D., and especially during the sole rule of the latter from 259 to 268 A.D. Chief among these tyrants were Postumus, under whose rule Gaul became virtually a separate kingdom; Celsus, who seized control of Africa; and Zenobia (q.v.), Queen of Palmyra.

**THIRTY YEARS' WAR,** a series of European conflicts, extending from 1618 to 1648, involving most of the countries of western Europe, and fought chiefly in Germany. At its inception, the struggle was primarily a product of the profound religious antagonisms engendered among Germans by the events of the Protestant Reformation (see REFORMATION). Religious animosity, especially as manifested by non-German coreligionists of the contending Protestant and Roman Catholic factions, broadened the war and ranked as a substantial factor in its later stages. As the struggle gained momentum, however, its direction and character were decisively influenced by various other issues, including the dynastic rivalries of ambitious German princes and the determination of certain European powers, notably Sweden and France, to curb the power of the Holy Roman Empire (q.v.), then the chief political instrument of Austria and the Hapsburgs

(qq.v.). The religious hatreds that flared into the Thirty Years' War had smoldered for more than half a century prior to 1618. In large measure, this situation had resulted from the weaknesses of the Peace of Augsburg (see AUGSBURG), an agreement concluded in 1555 between the Holy Roman emperor and the Lutheran princes of Germany. The treaty, while effecting a truce between the German Catholics and Protestants, failed to reconcile their basic differences. By several of its provisions, the treaty sharpened these differences. (For further information regarding the political and religious complications flowing from the Peace of Augsburg, see GERMANY: *History*.) The Thirty Years' War, probably the most calamitous and destructive conflict, to that time, in the history of Europe, may be divided into four phases, usually styled and dated as follows: the Palatine-Bohemian (1618-25); Danish (1625-29); Swedish (1630-35); and French (1635-48).

*Palatine-Bohemian.* With respect to the immediate background of the first phase of the war, it should be noted that religious tensions were seriously aggravated in Germany during the reign (1576-1612) of the Holy Roman emperor Rudolf II. Protestant churches in many parts of Germany were destroyed, restrictions were placed on the rights of Protestants to worship freely, and the Treaty of Augsburg became, in the hands of the emperor's officials, the basis for a general resurgence of Catholic power. With the establishment (1608) of the Evangelical Union, a Protestant defensive alliance of princes and cities, and of the Catholic League, a similar organization of Catholics, in the next year, a violent solution of the crisis became inevitable. The Bohemian section of the Evangelical Union struck the first blow. Outraged by the aggressive policies of the Roman Catholic hierarchy in Bohemia, the Bohemian Protestants, a majority of the population, demanded that King Ferdinand intervene. The king, an ardent Catholic and the Hapsburg heir presumptive, ignored the Protestant appeal. On May 23, 1618, the enraged Protestants of Prague invaded the royal palace, seized two of the king's ministers, and heaved them out of a window. This act, known in history as the Defenestration of Prague, inaugurated a national Protestant uprising.

Under the leadership of Count Heinrich Thurn (q.v.), the Protestant forces achieved numerous initial successes, and the rebellion swiftly spread to other parts of the Haps-



*Cannon of the type used in the Thirty Years' War (from an early drawing)*

burg dominions. For a brief period early in 1619 even Vienna, the Hapsburg capital, was threatened by Union armies. Later in 1619 the Bohemians bestowed the crown of the deposed Ferdinand on Frederick V, Elector of the Palatinate. Several sections of the Evangelical Union, which consisted chiefly of Lutherans, thereupon withdrew from the struggle, because Frederick was a Calvinist. Taking advantage of Protestant dissensions, particularly a declaration of war against Bohemia by Lutheran Saxony, and of a Spanish invasion of the Palatinate, Ferdinand, who had become Holy Roman emperor in August, 1619, quickly assumed the offensive. On November 8, 1620, a Catholic League army, commanded by Count Tilly (q.v.), routed the Bohemians at White Mountain, near Prague. Sanguinary reprisals were inflicted on the Protestants of Bohemia on the heels of this victory, and Protestantism was outlawed. Although the Evangelical Union disintegrated, Frederick and a few allies continued the struggle in the Palatinate. The Protestants defeated Tilly's army at Wiesloch in April, 1622, but thereafter met with successive disasters. By the end of 1624 the Palatinate, which was awarded to Maximilian, Duke of Bavaria, had been forcibly returned to the Catholic fold.

**Danish.** In its second phase the war, essentially, a German civil conflict up to that point, began to assume an international character. On the one hand, the rulers of various German Protestant states, fearful of re-

surgent Catholicism and indignant over the harsh treatment accorded their coreligionists, found it expedient to seek foreign assistance; on the other hand, the rulers of the United Kingdom, France, and certain other w. European powers were profoundly alarmed at the growing might of the Hapsburgs. Both France and the United Kingdom, then allies against Spain, were obliged to forego immediate intervention in the war because of domestic difficulties. At this juncture Christian IV (q.v.), King of Denmark and Norway, came to the aid of the beleaguered German Protestants. Christian's intervention was substantially motivated by nonreligious considerations, mainly territorial ambitions in n.w. Europe and a determination to end Hapsburg control of the Danish duchy of Holstein.

Supported by Lutheran and Calvinist German princes, Christian mobilized a large army in the spring of 1625 and invaded Saxony. The Protestant expedition encountered little effective resistance until the spring of 1626. In the meantime Albrecht von Wallenstein (q.v.), Duke of Friedland, had created a powerful army of mercenaries and entered the service of Ferdinand II, whose only other available force was that of the Catholic League under Tilly. Wallenstein's mercenaries won their initial victory at Dessau in April, 1626. On August 27, 1626, Tilly completely defeated the main body of Christian's army at Lutter am Barenberge. The combined imperial armies subsequently over-

ran, all of n. Germany, leaving innumerable pillaged towns and villages in their wake. With Wallenstein in pursuit, Christian retreated (1627) into the Jutland peninsula. Total victory for the imperial cause was signalized when, on March 6, 1629, Ferdinand issued the Edict of Restitution. By the provisions of this document, Protestant titles to all Catholic property acquired through the Peace of Augsburg were nullified. On May 12, 1629, King Christian accepted the Peace of Lübeck. Its terms deprived him of numerous small holdings in Germany.

*Swedish.* Ferdinand's successes in the second phase of the war sharpened the anti-Hapsburg orientation of Cardinal Richelieu (q.v.), chief minister of the French monarch Louis XIII. Unable because of recurring internal crises to intervene directly in Germany, Richelieu made overtures to the Swedish ruler Gustavus II (q.v.), better known as Gustavus Adolphus. A zealous Lutheran, Gustavus had already received appeals from the hard-pressed n. German Protestants. This circumstance, the promise of French support, and Swedish ambitions for hegemony in the Baltic region brought him into the conflict. In the summer of 1630 Gustavus landed a well-trained army on the coast of Pomerania. The rulers of Pomerania, Brandenburg, and Saxony shortly adopted a vacillatory policy on the question of participation in the Swedish venture, seriously delaying the start of the campaign. While Gustavus marked time, Tilly, who had been given command of Wallenstein's army, laid siege to Magdeburg, then in a state of insurrection against the Holy Roman Empire. The imperial armies captured the city on May 20, 1631, sacked and burned it, and massacred the Protestant inhabitants.

Tilly was repulsed by the Swedes on three occasions in the following summer. In the last of these battles, fought at Breitenfeld in September, Gustavus, with the help of the Saxons, routed Tilly's troops, about 6000 of whom were killed. Following Breitenfeld the Swedish army moved into s. Germany, where it spent the winter. The spring campaign brought numerous victories, notably the defeat (April 14, 1632) of Tilly, who was killed on the banks of the Lech R., and the capture of Munich. Faced with complete disaster, Ferdinand had meanwhile recalled Wallenstein to command the imperial war effort. Wallenstein, who hurriedly recruited a new army of mercenaries, invaded Saxony in the fall of 1632. The Swedish army followed and

on November 16 attacked the imperial force, then intrenched at Lützen. At the conclusion of the ensuing battle, which cost Gustavus his life, Wallenstein's army was forced to withdraw. Bernhard, Duke of Saxe-Weimar, who succeeded to Gustavus' command at Lützen, overran Bavaria after this victory, but during 1633 Wallenstein struck repeated blows against the Swedish strongholds in Silesia. Toward the close of 1633 Wallenstein initiated a peace movement among leading circles of the imperial armies. Removed from his command by Ferdinand on suspicion of treason, Wallenstein then entered into peace negotiations with the Protestant leaders. His attempts to end the war aroused the enmity of his own officers, and on February 25 he was assassinated. The imperial armies inflicted a devastating defeat on Duke Bernhard at Nördlingen on September 6, 1634. Dismayed by this catastrophe, the leaders of the Protestant coalition swiftly abandoned the struggle. The Peace of Prague (1635), which formally ended the third phase of the war, provided for certain concessions to the Saxon Lutherans, particularly basic modifications of the Edict of Restitution.

*French.* In its final phase, the war became an imperialist conflict between the Hapsburgs and France, which was still under the leadership of Richelieu, for hegemony in w. Europe. Religious issues figured insignificantly in the final phase, which opened, in May, 1635, with a French declaration of war against Spain, the chief Hapsburg dominion aside from Austria. In alliance with Sweden and various German Protestant leaders, including Duke Bernhard, France quickly overcame serious difficulties that developed during the first stage of the fighting. The Swedish general Johan Banér defeated a combined force of Saxons and Austrians at Wittstock on October 4, 1636, materially damaging the Hapsburg position in Germany. In 1636, Spanish invasions of French territory were repelled. The Hapsburg position in Germany was further damaged by a defeat inflicted by Duke Bernhard at Rheinfelden on March 3, 1638. Following these setbacks the imperial armies were forced to surrender one after another of their European strongholds. Between 1642 and 1645 the Swedish general Lennart Torstenson scored numerous triumphs, overrunning Denmark, which had become allied with the Empire, and ravaging large sections of w. Germany and Austria. In the w., the French, under generals Prince Louis II de Condé and Vicomte Turenne

(qq.v.), were also generally successful. Condé routed a Spanish army at Rocroi in May, 1643. In the following November the French suffered a severe defeat at Tuttlingen, but thereafter the Hapsburg war effort produced very few successes, and those largely of a minor character.

The combined armies of Condé and Turenne badly mauled a Bavarian army at Friburg im Breisgau in August, 1644. On August 3 of the next year the French commanders defeated an Austro-Bavarian army at Allersheim, near Nördlingen. Representatives of the Empire and the anti Hapsburg coalition began peace discussions at Westphalia and Osnabrück in 1645, but the negotiations, primarily a concession to the war-weary peoples of w. Europe, were destined to remain fruitless for a protracted period. However, an invasion of central Bavaria forced Maximilian I to conclude a separate peace early in 1647.

Despite these and other reverses, Ferdinand III, the son and successor (1637) of Ferdinand II as Holy Roman emperor, refused to negotiate desultory fighting continued in Germany, Luxemburg, the Low Countries, Italy, and Spain throughout the remainder of 1647. In the fall of 1647 Maximilian I re-entered the war on the side of the Empire. Another army of Bavarians and Austrians was defeated in May, 1648. This defeat, Swedish investment of Prague, French and Swedish investment of Munich, and an important French victory (August 5) at Lens compelled Ferdinand, who was also confronted with the threat of an assault on Vienna, to agree to the victors' peace conditions.

Incorporated in the document known in history as the Treaty of Westphalia (see WESTPHALIA, TREATY OF) and signed at Munster on October 24, 1648, the peace conditions fundamentally influenced the subsequent history of Europe. In addition to establishing Switzerland and Holland (the Netherlands) as independent states, the treaty, among other things, permanently and gravely weakened the Holy Roman Empire and the Hapsburgs, insured the emergence of France as the chief power on the Continent, and disastrously retarded the political unification of Germany. The economic, social, and cultural consequences of the war were incalculable, with Germany, previously one of the most prosperous regions of Europe, the principal victim. According to conservative estimates, no less than half of the German people perished during the war. Countless German



New York State Museum

Swamp thistle (*Cirsium muticum*)

cities, towns, villages, and farms were totally destroyed. Approximately two thirds of the industrial, agricultural, and commercial facilities of Germany were in ruins. Religion no longer figured as a potent factor in German life, and education and other forms of intellectual activity had come to a virtual standstill.

**THISTLE**, common name applied to a family of plants, the *Carduaceae*. The Thistle family, and sometimes called the Aster family, is the largest family of flowering plants, containing about 800 genera and over 10,000 species. The plants are world wide in distribution; many of them are cultivated ornamentals. The Thistle family and the Chicory (qq.v) family were formerly included in the family *Compositae* (qv). For further information on well-known members of the Thistle family, see *ARNICA*; *ASIFR*; *CHRYSAETHYLUM*; *COREOPSIS*; *EUPATORIUM*; *GOLDENROD*; *IRONWELD*; *RAGWORT*; *RUDBECKIA*; *SUNFLOWER*.

The name "thistle" is applied in a restricted sense to plants in several genera of the Thistle family, including *Cirsium*, *Carduus*, *Echinops*, *Onopordum*, *Silybum*, *Centaurea*, and *Cnicus*. The common characteristic of plants in these genera is the possession of spiny leaves and branches, and of

sharp, spiny bracts surrounding the flowers. The common, plumed, or bull thistle is *Cirsium lanceolatum*, which bears purple flowers; the Canada thistle, *C. arvensis*, bears small lilac or white flowers. *Carduus* includes the plumeless thistles; *C. nutans*, the musk thistle, is common in fields in northeastern United States and bears purple flowers. The globe thistle, *Echinops sphaerocephalus*, which bears whitish or blue flowers, is frequently cultivated in the United States, as is the milk thistle or lady's thistle, *Silybum marianum*, which bears purple flowers. The cotton or Scotch thistle, *Onopordum acanthium*, has large heads of purple flowers. *Centaurea* contains the star thistle, *C. calcitrapa*, with purplish flowers; the blessed thistle, *Cnicus benedictus*, bears large heads of yellow flowers.

The name "thistle" is often erroneously applied to spiny plants which resemble true thistles but do not belong to the Thistle family. The sow thistles, for example, constitute the genus *Sonchus* of the Chicory family, and the Russian thistle, *Salsola pestifer*, belongs to the Saltwort family.

**THISTLE, ORDER OF THE**, called also the **ORDER OF ST. ANDREW**. The earliest known mention of the thistle as the national badge of Scotland is in the inventory of the effects of James III. The Order of the Thistle was revived by James VII (II of England) in 1687. After falling into abeyance during the reign of William and Mary, the order was revived by Queen Anne in 1703. The statute of 1827 limits the number of knights to sixteen members of the Scottish nobility, in addition to the sovereign and princes of the blood. The motto is *Nemo me impune lacessit*.

**THOBURN**, JAMES MILLS (1836-1922), American Methodist Episcopal missionary bishop, born in St. Clairsville, Ohio. From 1859 to 1908 (except for 1886-88) he was a missionary in India, becoming presiding elder of the Indian Conference, and for the last twenty years of the period being missionary bishop of India and Malaysia. His works in-

clude *The Christian Conquest of India* (1906) and *India and Southern Asia* (1907).

**THÖKÖLY, TÖKÖLYI, or TÖKÖLI**, COUNT IMRE (1656-1705), Hungarian patriot. He belonged to a Lutheran family and was born in the Castle of Késmárk, in the county of Zips. His father, Count Stephen, was implicated in a conspiracy against Leopold I of Austria; and after his death, and the execution of the leaders of the conspiracy, young Thököly sought an asylum in Poland, where he had large possessions. After vain endeavors to recover from the emperor his patrimonial estates he obtained the support of Apafi, Prince of Transylvania, and in 1678 he took the lead in an insurrection in Hungary. He captured a number of towns, and even penetrated into the heart of Moravia. The Turkish sultan, Mohammed IV, espoused his cause, and in 1682 declared him prince of Hungary under Turkish suzerainty. Thököly joined the Turks in the great onslaught on Austria in 1683, but after the disaster to the Turks at Vienna many of his followers fell off from him, and in 1685 he was imprisoned by the Turks. He was soon released and unsuccessfully resumed operations. In 1689 he was made prince of Transylvania by the sultan, and invaded that country with a Turkish army, but was forced back into Wallachia. He took part in the subsequent campaigns against Austria, and after the Peace of Karlowitz he was made by the sultan prince of Widdin and resided as the sultan's pensioner at Constantinople, where he died.

**THOLUCK**, FRIEDRICH AUGUST (1799-1877), German Protestant theologian, born in Breslau. He was professor at Berlin (1823) and, after 1826, at Halle. His commentaries on the Psalms, the Sermon on the Mount, John, Romans, and Hebrews have all been translated into English. His best-known works are *Die Wahre Weihe des Zweiflers* (Eng. trans., "Guido and Julius", 1854) and *Stunden Christlicher Andacht* (Eng. trans., "Hours of Christian Devotion", New York, 1875).

